WE STOP HEAT COLD

HEAT SINK/DISSIPATOR PRODUCTS AND THERMAL MANAGEMENT GUIDE

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INTERNATIONAL ELECTRONIC RESEARCH CORPORATION

The most comprehensive line of heat sinks/dissipators for cooling semiconductors

Since 1954 IERC has pioneered development of semiconductor heat dissipators, and we continue to design and produce highly effective and economical cooling devices for the electronics industry. Today IERC's complete line of heat dissipators/heat sinks for cooling semiconductor devices is used internationally. We continually enhance our product line as ongoing development efforts result in meaningful products for the electronics industry.

Emphasis is placed upon production of a quality product, meeting delivery commitments, and maintaining a financially sound and efficient company.

Administrative, engineering and manufacturing functions are carried out in our fully integrated facilities located in Burbank, California. To maintain our competitive posture, constant attention is given to improving efficiency through the use of modern management techniques and the latest production/process procedures.

Our competent engineering staff continuously monitors the electronics industry for new heat dissipator requirements. We welcome the opportunity to undertake a new design effort to solve a customer's thermal problem.

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Introduction to the catalog

In the preparation of this catalog, IERC has made a major effort to provide the electronic design engineer with the most comprehensive and up-to-date information available. The aim of this is to allow the engineer to find, in one location, all the information he will normally require in order to select a suitable heat dissipator. In reality it is two catalogs in one: a technical catalog containing valuable technical information on thermal packaging and design, and a product catalog of IERC's line of heat sinks/dissipators.

The product catalog has been divided into distinct sections as shown in the *Contents*, where each section contains a separate data base reflecting specific application information. The key elements of this data base are the thermal performance graphs which have been provided for each part depicted in this catalog. Over a year has been invested in laboratory testing to obtain accurate thermal performance data under conditions that represent real world application as closely as possible in a laboratory environment. The resulting curves show the semiconductor case temperature rise above ambient, plotted against power dissipated. This format allows the engineer to accurately determine the case temperature rise that can be expected for a given power dissipation level.

Two indices have been provided in each heat dissipator section in order to facilitate selection. They have been arranged by both thermal performance and board area requirement so that whichever is your most pressing constraint will lead to the optimum dissipator for your application.

Thermal resistance values shown in the indices are given for reference use only. They allow the engineer to "zero in" on a suitable dissipator and should not be used to predict actual thermal performance. This factor is further discussed in the heat dissipator selection guide contained in the lead of each section and in "Principles of Thermal Management."

An important feature of this catalog is the inclusion of the technical article entitled "Principles of Thermal Management," which offers an overview of the factors that affect thermal performance. Included in this article are several tables that provide data regarding surface emissivities, conduction characteristics of different materials, semiconductor case type thermal performance, and typical interface thermal resistance. The goal of the article is to acquaint the engineer with factors that need to be considered when applying thermal management to electronic equipment.

All IERC products may be ordered by either the IERC part number or by our customer's part number (or drawing number) for which we have a copy on file. IERC maintains a complete document control department which contains copies of all drawings either originated by IERC or sent in by our customers. This close control allows us to easily cross-reference customer numbers to IERC part numbers in order to quote or manufacture our products. We are pleased to provide our customers with detailed blueprints of our standard products in order to assist in the preparation of part drawings or purchase specifications.

Before progressing into the product sections we would first like to acquaint you with IERC's capabilities and services.

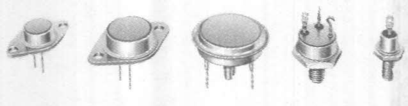
HEAT SINK/DISSIPATOR INDEX BY COMPONENT TYPE

FOR GREATER HEAT DISSIPATION

SECTION 1

METAL CASE MOUNTED SEMICONDUCTORS

TO-3, TO-3 IC, TO-66, TO-66 IC,
DO-8, DO-4, TO-15, DO-36



HORIZONTAL BOARD MOUNTED

Part Series	Page	Configuration
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LB66B2	1-4	
LA–A2	1-5	
LB66B1	1-4	
LA–A3	1-6	
LA363B7	1-12	
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LA–B7	1-7,9	
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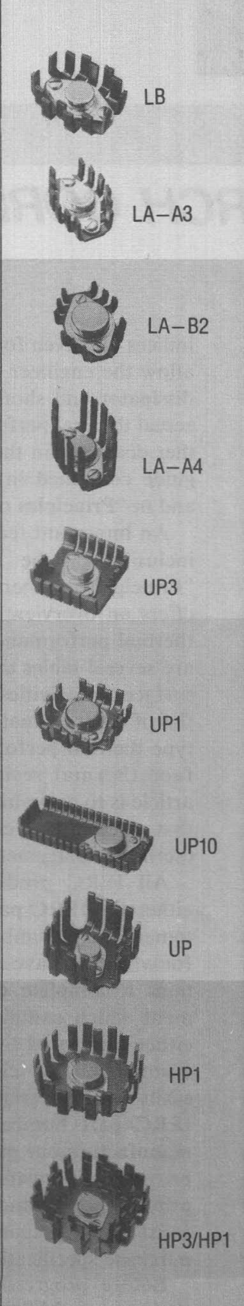
UP2	1-16,17	
UP10–2	1-18	
UP	1-17,18	
HP1	1-19–1-21	
HP3	1-21–1-25	
HP3/HP1	1-25	



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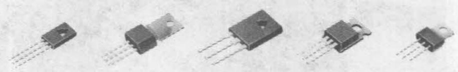
SECTION 2

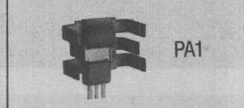
PLASTIC CASE MOUNTED SEMICONDUCTORS

TO-126, TO-127, TO-202, TO-220
Case 152, F-36



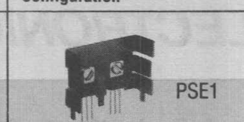
FREE STANDING CLIP ON

Part Series	Page	Configuration
PSC2	2-6,2-8	
PA2-7	2-9	
PA1-7	2-9	



VERTICAL BOARD MOUNTED

Part Series	Page	Configuration
PSB2	2-10	
PB1-36	2-10	
PSE1	2-12	
PSD1	2-11	



HORIZONTAL BOARD MOUNTED

Part Series	Page	Configuration
PA2	2-5	
PC1	2-4	
PA1	2-4	
PB2	2-6	
LA–A1	2-15	
PB1	2-5	
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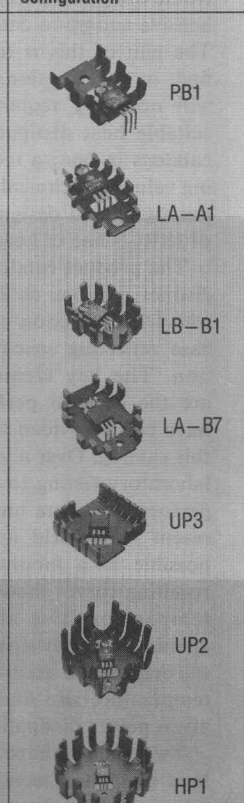
LA–B5	2-19	
UP2	2-21	
UP	2-22	
UP10	2-23	
HP1	2-24	
HP3	2-25	



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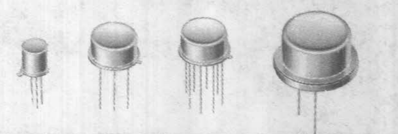
SECTION 3

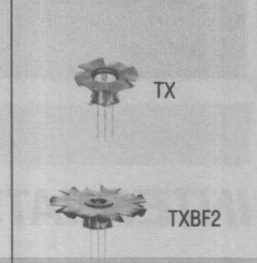
METAL LEAD MOUNTED SEMICONDUCTORS

TO-5, TO-5 IC, TO-8, TO-8 IC, TO-18, TO-18 IC,
TO-74 thru TO-80, TO-96, TO-97, TO-99, TO-100



FAN TOPS

Part Series	Page	Configuration
TO-18		
TXBF	3-4	
TO-5		
TXBF	3-4	
TXCF	3-5	
TXBF2	3-5	
TO-8		
TXBF2	3-6	
TXCF	3-6	



HORIZONTAL BOARD MOUNTED

Part Series	Page	Configuration
TO-18		
LP18	3-10	
TO-5		
LP–A2	3-12	
LP–A1	3-11	
LP–B4	3-16	
LP–B2	3-14	
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LP–C1	3-17	
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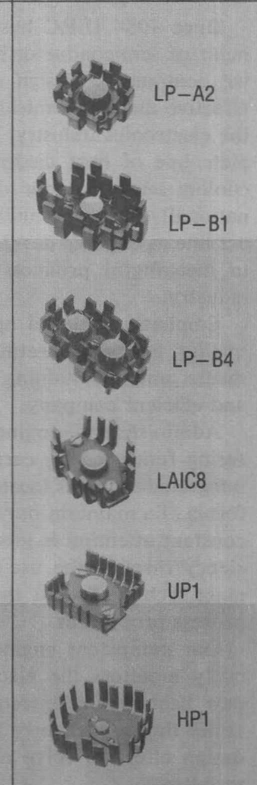
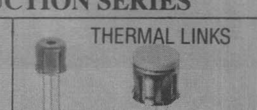
LAIC8B3	3-22	
LAIC8B4	3-22	
UP1-TO8	3-24	
LAIC8B5	3-23	
UP2-TO8	3-24	
UP-TO8	3-25	
HP1-TO8	3-25	
HP3-TO8	3-26	



TX CONDUCTION SERIES

TO-18	3-7	
TO-5	3-8	
TO-8	3-9	

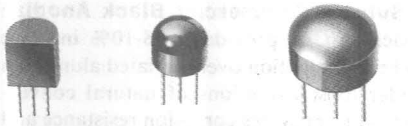


HOLE PATTERNS & CLAMPS ON PAGE 3-27

SECTION 4

PLASTIC LEAD MOUNTED SEMICONDUCTORS

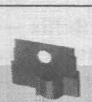
TO-92, TO-98, all "D" case plastic and round ceramic case devices



FREE STANDING SINGLE MOUNT

Part Series	Page	Configuration
TX	4-5	 TX
RUR671	4-7	

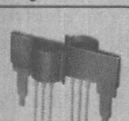
FREE STANDING DUAL MOUNT

Part Series	Page	Configuration
RUR672	4-8	 RUR

SOLDER IN SINGLE MOUNT

Part Series	Page	Configuration
RU671	4-6	 RU
R20-1	4-4	

SOLDER IN DUAL MOUNT

Part Series	Page	Configuration
RU672	4-7	 RU
R20-2	4-5	

FAN TOP ROUND CERAMIC CASE

Part Series	Page	Configuration
TX	4-5	 TX

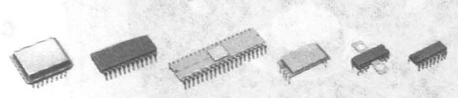
SCREW MOUNT CLIP ROUND CERAMIC CASE

Part Series	Page	Configuration
RC	4-6	 RC

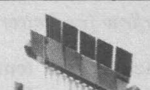
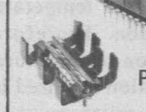
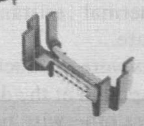
SECTION 5

DIPS, FLATPACKS, MICROCIRCUITS AND PIN GRID ARRAYS

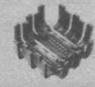
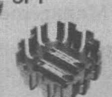
All DIPs, Flatpacks and Microcircuits



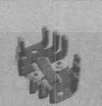
.3" WIDE DIPs—SINGLE MOUNTING

Part Series	Page	Configuration
PB2-10	5-5	 PEP
LIC214A1	5-6	 PB1
PB1-10	5-5	 LIC
LIC214A2	5-6	
PEP50AB	5-4	
LIC214A3	5-7	
LIC214A4	5-7	
PEP50BB	5-4	

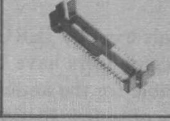
.3" WIDE DIPs—DUAL MOUNTING

Part Series	Page	Configuration
UP1-348	5-8	 UP1
UP2-348	5-8	 UP
UP-348	5-9	
HP1-348	5-9	

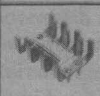
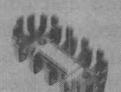
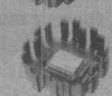
MP32H

Part Series	Page	Configuration
LA414B2	5-10	 LA
LA414B3	5-10	
LA414B4	5-11	
LA414B5	5-11	

.6" WIDE DIPs

Part Series	Page	Configuration
APIC025	5-12	 API
APIC050	5-12	
APIC075	5-13	

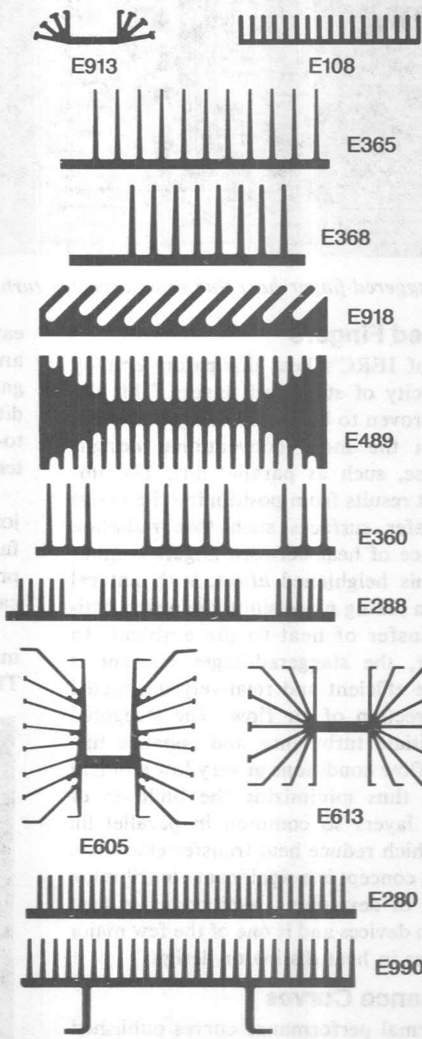
HYBRID MICROCIRCUITS

Part Series	Page	Configuration
LBOC2-60	5-13	 LBOC1
LBOC2-65	5-14	
LBOC1-60	5-14	
LBOC1-65	5-15	
LBOC2-61	5-15	 LBOC2
LBOC2-72	5-16	
LBOC1-61	5-16	
LBOC1-72	5-17	 HP1
HP1-218	5-17	

HOLE PATTERNS & HEAT SINK RETAINERS ON PAGES 5-18, 19

SECTION 6

EXTRUDED HEAT SINKS FOR SEMICONDUCTORS



For our complete selection of extrusions, see Section Six.

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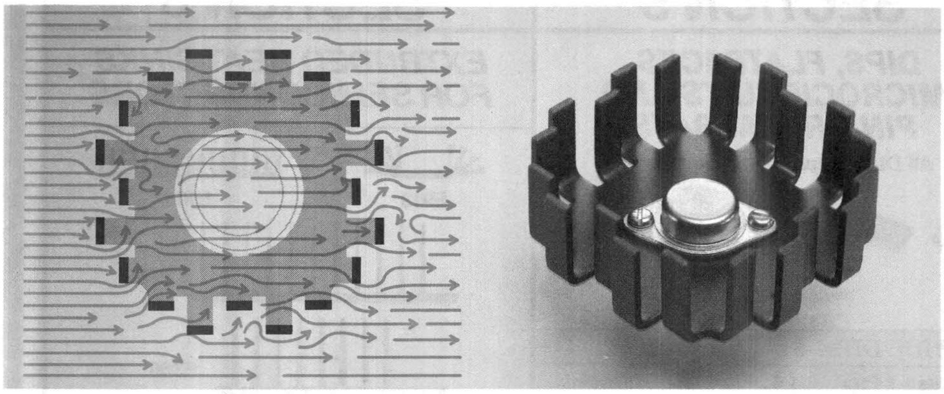
WE STOP HEAT COLD

GENERAL PRODUCT INFORMATION



IERC's staggered-finger heat sink design creates turbulent airflow for better heat dissipation.

Staggered Fingers

Many of IERC's heat dissipators employ a multiplicity of staggered fingers. This design has proven to be considerably more efficient than the more conventional designs now in use, such as parallel fins. The improvement results from positioning the major heat transfer surfaces such that radiation transference of heat between fingers is minimized. This heightened effect, with natural convection taking place simultaneously, optimizes transfer of heat to the ambient. In forced air, the staggered-finger concept is even more efficient and relatively unaffected by the direction of air flow. The staggered fingers initiate turbulence and enhance turbulent airflow conditions at very low ambient velocities, thus minimizing the build-up of boundary layers so common in parallel fin designs which reduce heat transfer efficiency. This basic concept is a significant contribution to the art of developing semiconductor heat dissipation devices and is one of the few major innovations in heat dissipator design.

Performance Curves

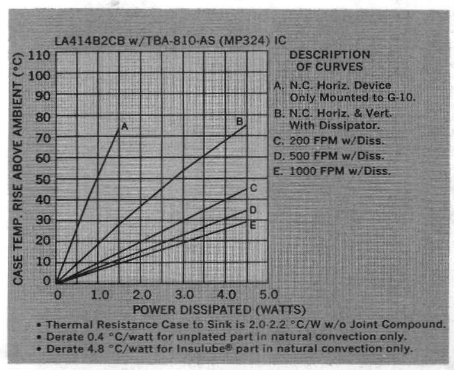
All thermal performance curves published by IERC are the result of actual tests performed in our engineering test laboratory in strict compliance with Electronic Industry Association's Bulletin No. 5, entitled "Recommended Test Procedures for Semiconductor Thermal Dissipating Devices." These curves are accurate and the original test report and data are available upon request. We are also pleased to supply copies of EIA Bulletin No. 5 for your reference.

All performance curves in this catalog are for the device and dissipator specifically referenced. Test devices were selected based upon popular usage and ability to accurately represent other similar JEDEC outlines. All testing was performed with the device/dissipator combinations mounted to bare 6 x 6 x .062 G-10 circuit boards to represent "worst case" circuit board applications. "Rating factors" are supplied with each curve, which allow the user to adjust the given data in order to predict performance for other dissipator finishes.

These thermal performance curves delineate the actual case temperature rise above ambient condition. Therefore, in order to gauge the junction temperature, the only additional information required is the junction-to-case thermal resistance and your ambient temperature.

All tests were conducted utilizing a thermal joint compound at the device/dissipator interface unless otherwise noted. This permits reproducible test results and gives a valid indication of dissipator thermal performance.

Other factors affecting dissipator performance are discussed in the "Principles of Thermal Management."



Materials

All materials used by IERC in the fabrication of heat dissipators have been selected as the best available for the anticipated use. With the exception of a few dissipators which require the exceptional spring characteristics of beryllium copper or brass, most of our standard IERC heat dissipators are fabricated from high thermal conductivity wrought aluminum alloys. The material thickness and specific alloy are selected in order to optimize the performance of the given heat dissipator geometry, taking into consideration thermal inertia, conduction, mechanical properties and cost. If, for any reason, more information is needed on specific alloys or alternate materials, please contact IERC. Typical heat dissipator materials include: Aluminum stampings — 6061, 1100, 5052, 3003 per QQ-A-250; Beryllium copper per QQ-C-533; Copper per QQ-C-576; Brass per QQ-B-626.

Coatings / Finishes

(1) FOR ALUMINUM DISSIPATORS.

Standard available finishes for most of our aluminum dissipators are noted below along with suffix letters typically appearing with the identifying part number.

CB Suffix — Commercial Black Anodize Black anodize provides an 8-10% increase in heat dissipation over unplated aluminum under most conditions of natural convection. Also provides corrosion resistance and improved esthetics.

B Suffix — Military Black Anodize. Identical to Commercial Black Anodize but provision is made for certification of anodizing process in accordance with MIL-A-8625.

U Suffix — Unplated. Basic material is left without a coating and is recommended where cost is a major factor and the operating environment is not conducive to corrosion.

"No Letter" Suffix — Insulube 448®. Lack of a suffix letter typically indicates the use of IERC's Insulube 448® coating system. This non-hygroscopic coating is recommended where electrical insulation and/or a high degree of protection against severe corrosive environment is needed. This coating was specially developed and tested by IERC to provide exceptional protective properties with minimal loss of heat transfer characteristics. Typical electrical insulation is 500 VDC.

In addition to the above finishes, IERC will provide the following upon request:

R Suffix — Irridite/Chromate. Finish recommended for electrical conductivity and where resistance to mild corrosive environment is desired. Process per MIL-C-5441.

T Suffix — Tin Plate. Per MIL-T-10727. Recommended for applications where electro-deposited pure tin is required.

TC Suffix — Commercial Tin. Recommended for easy solderability of dissipators with integral tabs for attachment to P.C. boards. Parts are hot-dipped with 60/40 tin-lead alloy.

TCB Suffix — Tin Plate, Black Coating. Available on vertical mount heat sinks to allow easy solderability to circuit board. Dissipator is tin plated all over then painted black with a coat of IERC's special urethane based paint (known as the 0510 coating system) to enhance appearance and thermal performance. The mounting tabs are masked to preserve the tin plate.

ND Suffix — Nickel Plate. Provides solderability for dissipators to be soldered to P.C. board or to which accessory components may be soldered. Process per QQ-N-290. Less solderable than tin plate and requires an activated flux. Dull finish to enhance emissivity.

(2) FOR COPPER ALLOY DISSIPATORS. Standard available finishes for all our copper alloy dissipators.

B Suffix — Black Cadmium. This finish provides corrosion resistance and enhances radiation efficiency. Finish per QQ-P-416.

CB Suffix — Black Chemical Film. Provides a black finish for commercial purposes where esthetics are important and the environments are not especially severe.

U Suffix — Unplated.

"No Letter" Suffix — Insulube 448®. (See previous note.)

In addition to the above finishes, IERC will provide the following upon request:

G Suffix — Gold Plate. Per MIL-G-45204.

ND Suffix — Nickel Plate. Per QQ-N-290. (See previous note.)

INSULUBE 448® INSULATING FINISH

Positive electrical insulation up to 500 volts DC

Insulube 448® combines several properties and performance advantages not common to any other single insulating finish or material. It is non-hygroscopic, has high heat emissivity properties and retains its excellent dielectric and leakage resistance properties in high humidity environments.

Insulube 448® is not a paint, but rather a special coating system applicable to all metals and many other materials. The system starts with the proper surface preparation, after which a primer is applied. The basic coating which gives the insulating and protective properties is then applied, followed by a thin-film finish coat to increase the emissivity of the surface and give it dry-film lubricating properties. (The IERC Insulube 448® system without this final dry-film lubricant coating can be obtained by specifying IERC Insultek 445.)

The problems of bare edges with hard anodize, as well as the problem of moisture absorption, are eliminated by the use of Insulube 448®. It has been used on thousands of parts for space applications and other programs, and for standard airborne and ground equipment.

In production, Insulube eliminates the need for hard-to-handle, unreliable insulating parts such as mica washers.

Adverse environments? Insulube will withstand and protect against salt sprays, fungus, outgassing and many other damaging conditions, and is a superior dry-film lubricant.

IERC's coating facility is equipped with the most modern application and processing equipment, backed by a sophisticated chemistry and materials laboratory. Research and development constantly sparks new finishing applications. Additionally, the laboratory monitors and maintains complete control on materials, processes and coating systems, while testing and quality control are firmly established as a significant part of the laboratory and application facility operations.

PHYSICAL PROPERTIES	
Color	Dull Grey - Black
Thickness	.003″ ± .001″ Recommended
Pencil Hardness	7H to 8H
Flexibility	⅜″ Mandrel (ASTM D522)
Impact Resistance	Greater than 60 Ft. Lbs. (Gardner Method)
Thermal Conductivity	0.27 BTU/HR. / Ft² / °F/Ft. (IERC Method)
Abrasion Resistance (Tabor)	Greater than 5000 cycles/mil (CS17-1000gm) Fed. Test Method Std. No. 141, Method 6192
Emissivity	0.93 @ 25°C — 0.91 @ 92°C
Hardness (Knopp)	30. (ASTM D1474)
ELECTRICAL PROPERTIES (per MIL-STD-202)	
Dielectric Strength	1000 volts DC/MIL minimum (Method 301) (Note 1)
Insulation Resistance	50,000 Megohms at 500 VDC (Method 302) (Note 1)
ENVIRONMENTAL TESTS	
Temperature Range	−54°C to +200°C
Salt Spray Resistance	MIL-STD-202, Method 101, Cond. B, Unaffected after 3000 hrs.
Humidity	MIL-STD-202, Method 103A, Cond. B
Fungus Resistance	Exceeds MIL-E-5272A (All Types)
Outgassing in Vacuum	Less than .5%

CHEMICAL RESISTANCE @ 25°C

Distilled Water	3000 Hrs. Unaffected	Skydrol 500A and 7000	1000 Hrs. Unaffected
Potable Water	3000 Hrs. Unaffected	Sulfuric Acid (25%)	1000 Hrs. Unaffected
Ketones	1000 Hrs. Unaffected	Citric Acid (10%)	1000 Hrs. Unaffected
Alcohols	1000 Hrs. Unaffected	Ammonium Hydroxide Fumes	1000 Hrs. Unaffected
Esters	1000 Hrs. Unaffected	Liquid Detergent	1000 Hrs. Unaffected
Aromatic & Aliphatic Hydrocarbons	1000 Hrs. Unaffected	Sodium Chloride (25%)	1000 Hrs. Unaffected
Hydraulic & Lubricating Oils	1000 Hrs. Unaffected	Ferric Chloride (5%)	1000 Hrs. Unaffected
Gasoline & Diesel Fuel	1000 Hrs. Unaffected	Sodium Hypochlorite (5%)	1000 Hrs. Unaffected

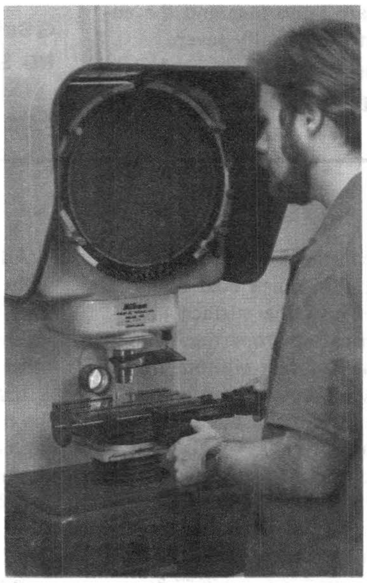
Note 1: The electrical properties are from tests conducted on flat test plates. Parts which are not of a flat configuration and to which standard electrodes cannot be attached are tested at 500 VDC and 50,000 megohms minimum in critical areas.

Consult the IERC Engineering Department for advice on special applications of this unique coating. Finished dimensions of parts can be held to reasonable tolerances if coating thicknesses are considered when parts are built. Write for advice regarding dimensions.

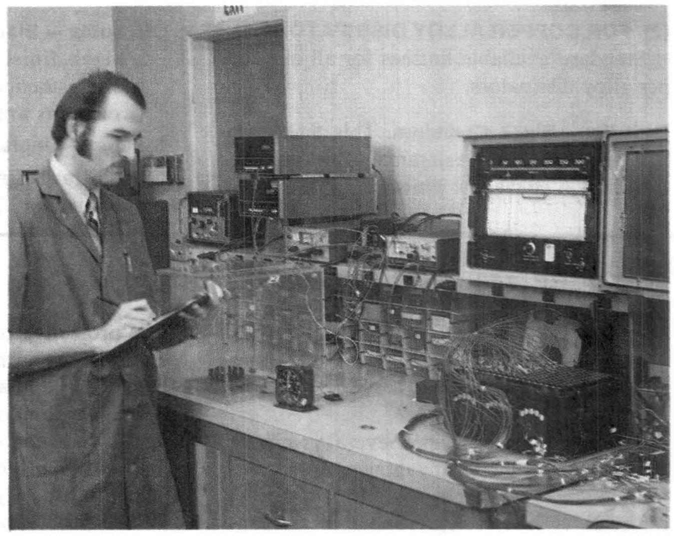
CAPABILITIES AND SERVICES

Technical Assistance

Change in the electronics industry is a fact everyone must deal with on a day-to-day basis. For this reason, we at IERC maintain a highly skilled, specially trained engineering staff. Our engineering personnel have years of experience in the design of heat sinks, dissipators and thermal management systems. The services of our engineering staff are available to our customers at any time to help solve heat dissipation problems. Technical services are also available through our local authorized technical field representatives. Contact your nearest IERC field representative or our factory in Burbank, let us know what your requirements are and we will do our best to be of assistance. Timely visits to your facility for direct technical discussions can be arranged.



This Optical Comparator assures quality of complex parts.

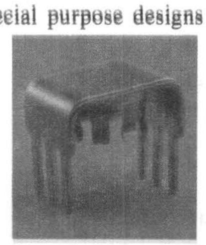


IERC's well-equipped in-house lab carries out extensive thermal testing.

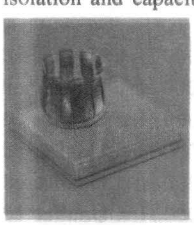
Custom Designs

Production tooling is already available for hundreds of variations of the standard products illustrated in this catalog. For example, more than 400 hole patterns are available for the dissipators shown in this catalog. Other special heat dissipator requirements can be met with minimal changes to existing designs. When a new design is neccessary you will have our enthusiastic and capable support. Customized heat dissipators are always of interest to us regardless of whether the requirement is a simple dissipator or complex thermal management system. An important part of our company operation is fast response to the technical needs of our customers.

Three examples of special purpose designs making use of standard components are illustrated.

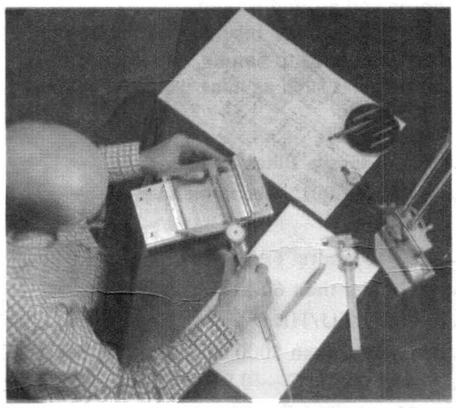


A specially designed dissipator/retainer providing excellent thermal efficiency in severe shock and vibration environment including high acceleration missiles. This design concept is also available with BeO insulation for electrical isolation and capacitance reduction.



A small plate riveted to a thermal link inertia for a high-wattage, short duty cycling TO-5 semiconductor. Careful design resulted in a low-cost solution to a difficult problem.

Modification to finger lengths or shape can frequently make room for a large dissipator in a small space or facilitate installation to a particular subassembly.



Continous quality control operations assure blueprint specifications are met.

Quality Products

All IERC heat dissipators are designed and manufactured at our Burbank, California facility under the close supervision of our professional quality assurance staff. Our products are known for quality as well as performance. We will never design or manufacture any item which to our knowledge may for any reason result in marginal performance in the final installation. Our quality assurance procedures meet highest commercial and military standards, and we take considerable pride in this aspect of our business.

Engineering Test Laboratory

IERC maintains an engineering test laboratory equipped with some of the most modern precision measurement devices and the highly qualified technicians necessary to accurately analyze the performance of heat dissipators. We continually evaluate the performance of new and modified heat dissipators for special applications under parameters set forth by our customers. All thermal/electrical testing is performed in strict compliance with EIA Bulletins 5 and 5-1, "Recommended Test Procedure for Semiconductor Thermal Dissipating Devices." Complete engineering reports resulting from these tests are made available as needed for customer review. This service is available to provide additional data on the performance of our products in support of your request for laboratory test data on a specific dissipation application.

The laboratory also contains the environmental test equipment necessary to certify our dissipators' ability to withstand heat, salt spray and thermal shock.

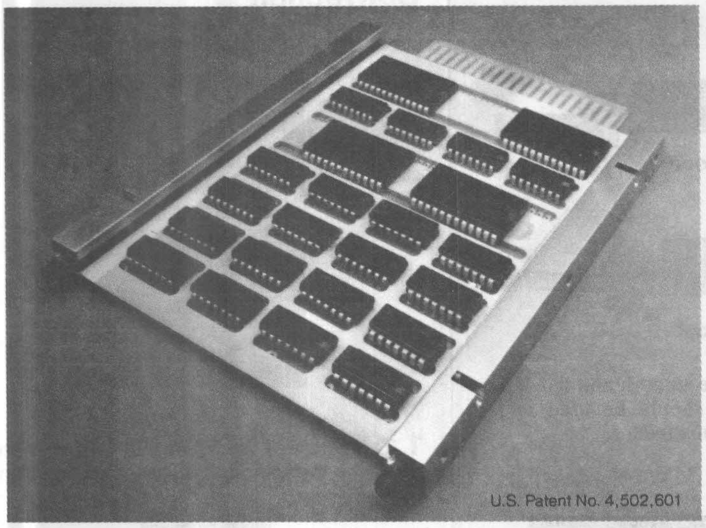
Prompt Delivery

A large inventory of finished parts is maintained at our headquarters in Burbank, California. In addition, our network of authorized industrial distributors maintains a local stock of our standard products to meet customer requirements in a timely manner. Most dissipators illustrated in this catalog can be obtained in limited quantities on an off-the-shelf basis. We are keenly aware of the need for on-time shipments and make every effort to meet specified delivery schedules.

Customer Service

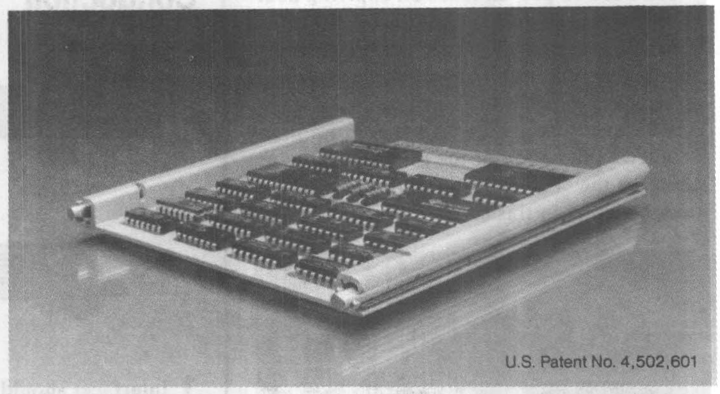
Our heat sinks/dissipators are used internationally by all levels of OEMs engaged in the manufacture of commercial and military electronic equipments. Our field technical representatives are well trained and strategically located throughout the United States and selected foreign countries to provide the finest service to satisfy your needs. In addition, our factory personnel in customer liaison positions are knowledgeable about our products and take pleasure in being of service. Simply contact any of our representatives or the factory—we are certain you will be well pleased with our response.

OTHER THERMAL MANAGEMENT PRODUCTS FROM IERC



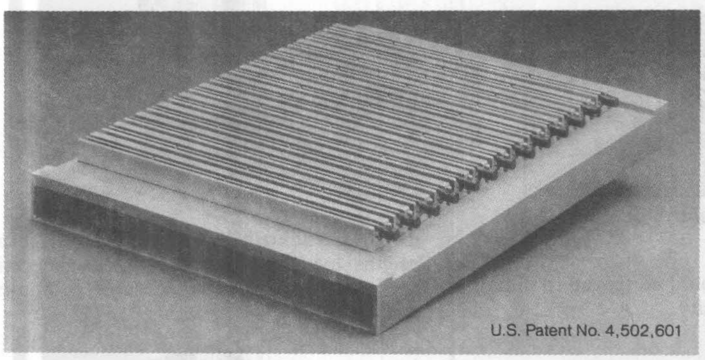
U.S. Patent No. 4,502,601

ZIF CIRCUIT BOARD RETAINERS
High performance military circuit board retainers that feature maximum thermal conductivity, superior retention under severe shock and vibration, as well as quick and easy quarter-turn locking action.



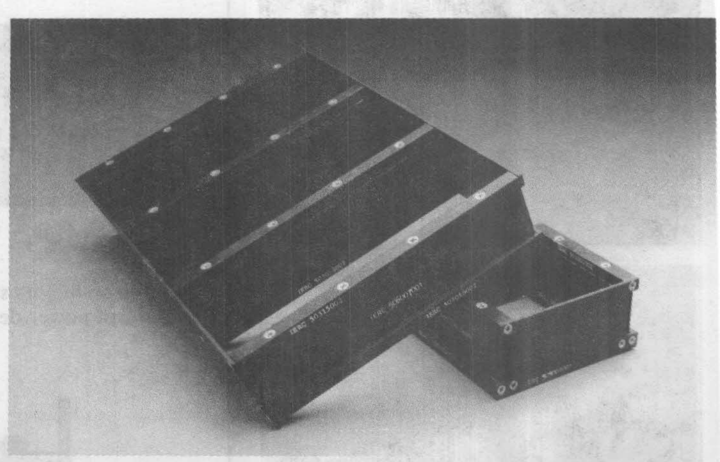
U.S. Patent No. 4,502,601

ZIF II HEAT SINK PLATE
A single extrusion which combines an aluminum heat sink plate with two ZIF retainers in a self-contained assembly. This system provides optimal component cooling through the highest thermal conductivity rating of any retainer available. The one piece design gives superior mechanical retention in an adverse military environment, while adding to the structural integrity of the enclosure.



U.S. Patent No. 4,502,601

COLDWALLS & ENCLOSURES
Engineered to take advantage of ZIF and ZIF II retainer features, IERC Coldwalls and Enclosures can be designed, fabricated and tested to meet your most demanding requirements with regard to dimensions, environment and thermal management specifications.



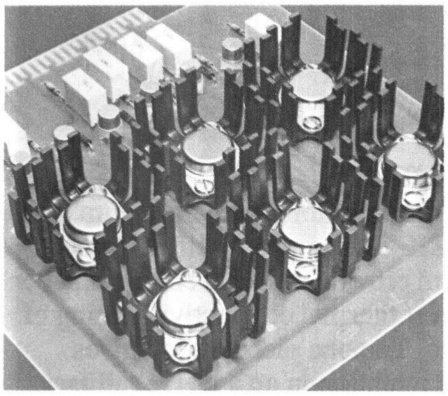
SEM CARD CAGES
A low cost electronic packaging concept for Standard Electronic Modules (SEM) which takes advantage of easy-to-design-with components and provides mechanical and thermal reliability in compliance with the military objectives.

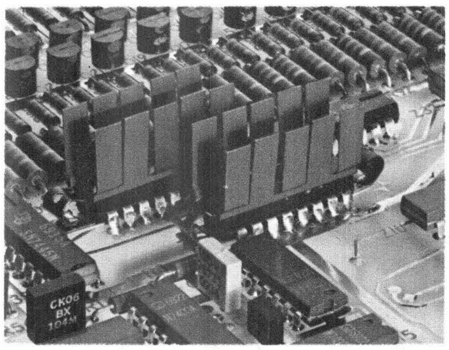
TUBE SHIELDS
Reliable, economic, tested-by-time designs for the protection and cooling of electron tubes.

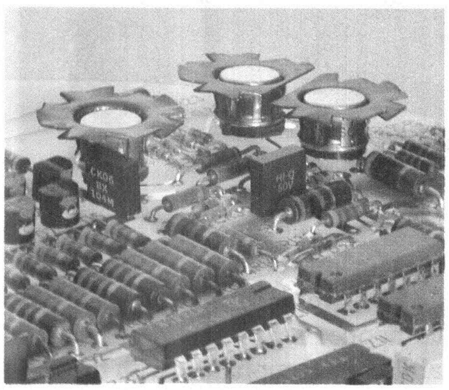
For more information on these and other IERC Thermal Management Products, contact your local IERC representative or call IERC direct at our headquarters in Burbank, California.

TIPS ON APPLICATIONS

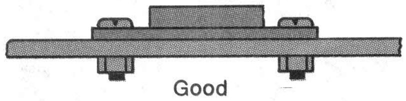
Here are 13 proven ideas on applying heat-transfer theory to circuit board and electronic packaging design. Tips on applications for conduction, natural convection, and forced air modes are given to assist you in designing a better heat dissipating package. For a more detailed explanation of the principles at work here, see the "Principles of Thermal Management" section in this catalog.



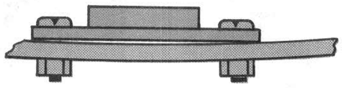




Conduction

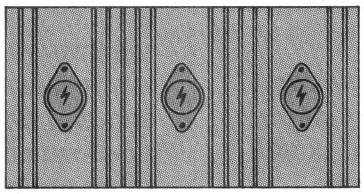


Good



Poor

1 Interfaces should be smooth and flat. Thermal paste or grease should be used on all interfaces whenever possible.



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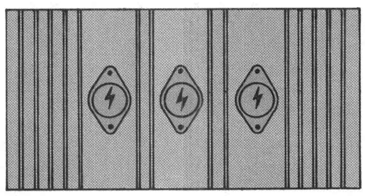
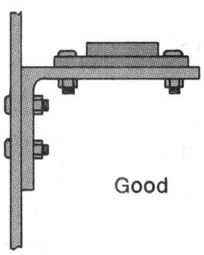


Poor

2 Semiconductors should be spaced to obtain a uniform power density.



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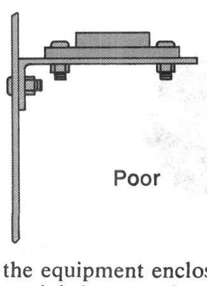
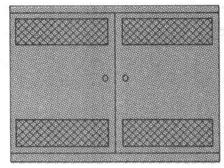


Poor

3 If part of the equipment enclosure is to be used as a heat sink be sure that its material thickness and interface areas are adequate to handle the expected power density.

Convection



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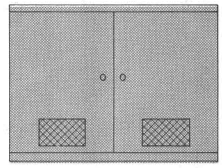
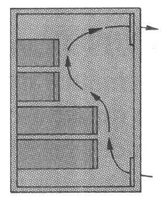


Poor

1 Cabinets and racks should be adequately vented at the top and bottom of the enclosure.



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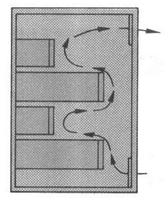
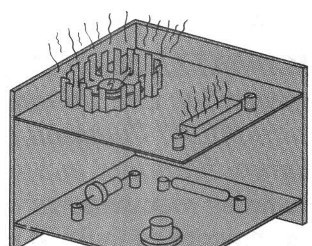


Poor

2 When racking equipment of different lengths avoid placing short heat-generating packages below longer pieces of equipment.



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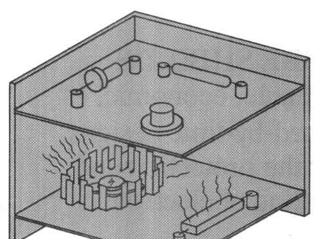
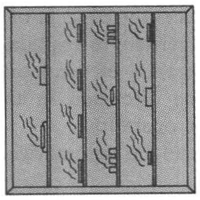


Poor

3 Heat generating devices should be placed near the top of the cabinet while the cooler, heat-sensitive components should be located lower in the cabinet.



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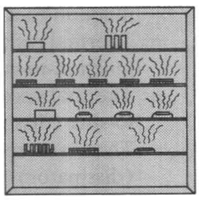
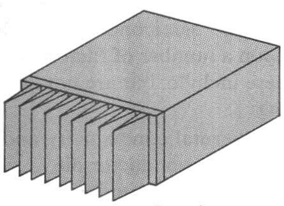


Poor

4 When racking many circuit boards, which will dissipate a significant amount of heat, it is better to place the boards in the vertical position to facilitate convection cooling.



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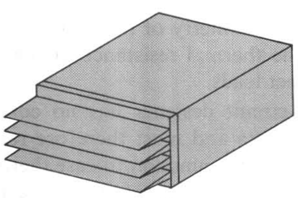
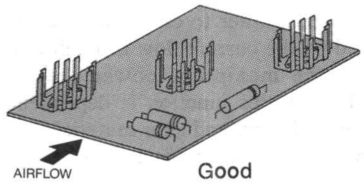


Poor

5 Fins on extruded heat sinks should be vertically aligned when natural convection cooling is used.

Forced Air



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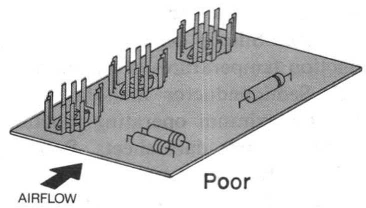
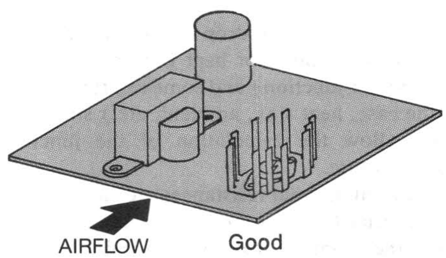


Poor

1 Board-mounted heat dissipators should be staggered so that air flow passes over all of them.



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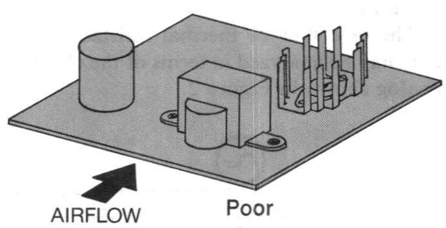
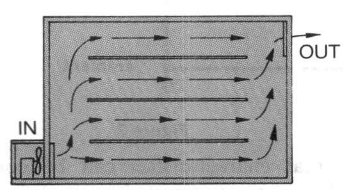


Poor

2 Care should be taken not to block the flow of air to heat dissipators.



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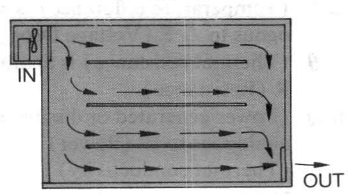
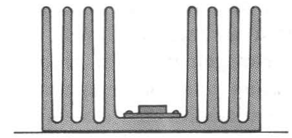


Poor

3 Forced-air cooling should be arranged to follow natural-convection air paths.

General



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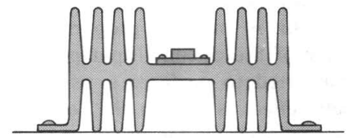
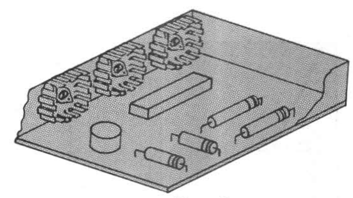


Poor

1 A high web extrusion should not be used in a horizontal natural-convection application.



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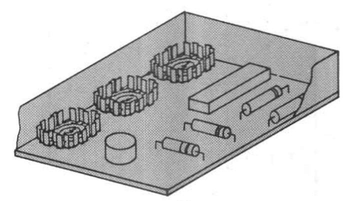

Poor

2 High-power devices with dissipators should be vertically mounted off the circuit board if possible, to avoid charring of the board and to improve dissipator performance.

PRINCIPLES OF THERMAL MANAGEMENT

The reliability and performance of electronic equipment is directly affected by the quality of the thermal management techniques that go into its design. The aim of thermal management is to properly control the operating junction temperatures of the various semiconductors that make up the equipment. A semiconductor's reliability is directly affected by its operating junction temperature. The heat generated in an electrical circuit is inversely proportional to the efficiency of the circuit. Input power that is not converted to perform a useful electromagnetic effect is lost in the form of heat. The safe, efficient, economical removal of this heat is the purpose of thermal management. Figure 1 demonstrates the improvement in component reliability that can be expected by the lowering of junction temperatures for several semiconductor junction types.

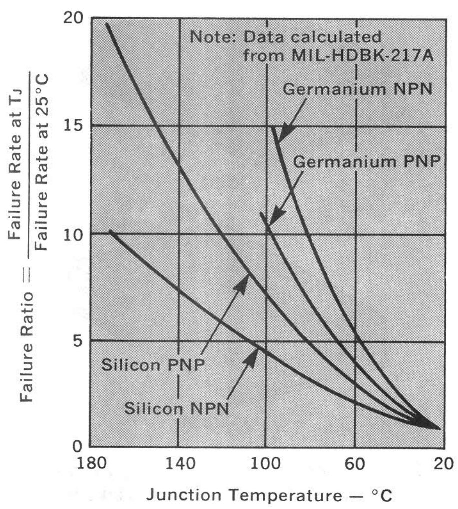

Figure 1
TRANSISTOR FAILURE RATIO VERSUS JUNCTION TEMPERATURE

In order to maximize the benefit of thermal management it is necessary to begin early in the design stage with an analysis of what components will be subject to high temperatures, and what will be required to cool these devices. This leads to an optimized circuit board layout by allowing space for heat dissipators when they are required. Additionally, components can be located geometrically so that hot spots can be separated, and components situated close to the support structure should conductive cooling techniques be applied. It can be very difficult, if not impossible, to retrofit densely packed circuit boards when a problem area is discovered late in the design stage.

It is not necessary to be an expert in thermal packaging to do these preliminary analyses. The following sections will attempt to provide the insight necessary to apply basic thermal management.

The Thermal Circuit

The heat generated in a transistor can be defined as the product of the voltage drop across the emitter to collector junction, multiplied by the current flow through that junction. The maximum power that can be handled by this junction is dependent upon the type of semiconductor material used in its manufacture and what is done to dissipate the generated heat.

Most germanium devices are capable of operating at a junction temperature of no more than 100°C. Silicon devices can be operated at junction temperatures of between 150 and 200°C. Semiconductor manufacturers typically list maximum operating junction temperature on their data sheets. Before going into the study of heat transfer it is necessary first to establish some basic concepts.

Thermal resistance (θ) is defined as the quotient of the temperature drop between two points and the heat flux (power) passing between them under steady state conditions.

$$\theta = \frac{\Delta T}{Q} \qquad (1)$$

The temperature drop is usually measured between the point of heat generation (semiconductor junction) and some reference point (the case, heat sink, ambient, etc.) since this will allow the calculation of the junction temperature.

Several thermal resistances are encountered in a series between the heat generation point and the ultimate heat sink, typically the ambient air.

The heat flow or thermal resistance problem may be analyzed in terms of the electrical analog shown in Figure 2.

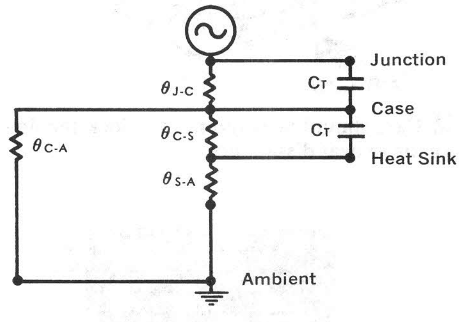

Figure 2

Thermal characteristics can be considered analogous to electrical characteristics where:

- ΔT (Temperature difference) is analogous to ΔE (Voltage Drop)
- θ (Thermal resistance) is analogous to R (Resistance)
- P or Q (Power generated or dissipated) is analogous to W (Power)
- K (Thermal conductivity) is analogous to σ (Conductivity)
- C_t (Heat capacity) is analogous to C (Capacity)
- t (Time) is analogous to t (Time)

The model uses an energy-storage element C_t, which introduces the concept of thermal capacitance (or inertia) to explain the transient thermal properties of semiconductors. This factor will be discussed in the section on pulsed power operation.

Figure 2 can be summarized mathematically as:

$$\theta_{j\text{-}a} = \theta_{j\text{-}c} + \theta_{c\text{-}s} + \theta_{s\text{-}a} \qquad (2)$$

where $\theta_{j\text{-}a}$ = Thermal resistance junction-to-ambient
$\theta_{j\text{-}c}$ = Thermal resistance junction-to-case
$\theta_{c\text{-}s}$ = Thermal resistance case-to-sink (dissipator)
$\theta_{s\text{-}a}$ = Thermal resistance sink (dissipator)-to-ambient

The following equation also derives from Figure 2 and can be utilized to determine heat sinking requirements:

$$\theta_{c\text{-}a} = \theta_{c\text{-}s} + \theta_{s\text{-}a} \qquad (3)$$

where $\theta_{c\text{-}a}$ = Thermal resistance case-to-ambient

$\theta_{j\text{-}c}$: Semiconductor Thermal Resistance

Heat transfer (or flow) from the heat generating junctions to the outside world begins in the semiconductor itself and depends upon a number of factors. In the device itself these include, but are not limited, to the following:

1) The thermal conductivity and geometry of the semiconductor die
2) The bond between the die and its mount
3) The thermal conductivity of the mount material
4) The geometry of the mount
5) The thermal resistance of the interconnect leads.

The circuit designer has no control over these factors and must therefore rely on the manufacturer's junction-to-case thermal resistance ($\theta_{j\text{-}c}$) rating. However, since many circuits are available in several shapes (TO-3, TO-66, TO-220, etc.) with different thermal characteristics, you may be able to lower temperatures by changing packages. (See Table 1 for approximate $\theta_{j\text{-}c}$ for typical semiconductor packages.) Figure 3 illustrates the thermal flow paths for several popular semiconductor packages.

$\theta_{c\text{-}s}$: Thermal Resistance Case-To-Sink

The first thermal resistance encountered external to the semiconductor is the thermal path through the semiconductor-to-heat sink thermal interface. What thermal control measures are taken here have a major impact on operating junction temperatures. For example, a TO-3 transistor case-to-sink interface can range from a low of 0.1°C/W (for an interface with no insulator and with thermal joint compound), to a high of approxi-

mately 2°C/W (with an insulator mounted dry). At a power dissipation of 15 W the TO-3 case (and also the junction) would be 15 W (2.0 - 0.1°C/W) or 29°C hotter in the latter case. Clearly, the failure to move the maximum amount of heat with the lowest possible temperature drop across this barrier can only be detrimental even to the best thermal design.

The thermal resistance across this or any other interface that may be encountered is a function of cross-sectional contact area, surface finishes, flatness of the surfaces, the applied load between the surfaces, and the thermal conductivity of what media is filling the small gaps that will occur in the interface area.

Table 1
THERMAL RESISTANCE, JUNCTION TO CASE
$\theta_{j\text{-}c}$ (°C/W)

Device — Case	Thermal Resistance Junction To Case
TO-18 (Glass Header)	130 - 220
TO-5 (Glass Header)	30 - 50
TO-5 (Metal Header)	20 - 40
TO-3 (Typical: 2N3055)	0.5 - 6.0 (1.5 max)
TO-66 (Typical: 2N3054)	1.5 - 15 (7.0 max)
TO-36, TO-6 (Typical: 2N174)	0.5 - 1.0 (0.5 max)
TO-63 (Typical: 2N4210)	0.4 - 2.0 (1.0 max)
TO-61 (Typical: 2N5678)	0.5 - 2.0 (1.0 max)
TO-8 (Typical: 2N1483)	1.5 - 15 (7.0 max)
DO-4 (Typical: 1N3879)	2 - 7 (2.5 max)
DO-5 (Typical: 1N1195A)	1 - 1.5 (1.2 max)
TO-126 (Typical: 2N4921)	4 - 15 (4.15 max)
TO-127 (Typical: MJE3055)	1 - 2 (1.39 max)
CASE 152 (MOTA) (Typical: MPSU01)	11 - 18 (11 max)
TO-220 (Typical: G.E. D44C8)	1.7 - 5 (4.2 max)
TO-116 (Kovar Frames) (Copper Alloy Frames)	59 - 91 30 - 40
TO-202 (Typical: G.E. D40D8)	15 - 25 (20.0 max)
TO-92	175 - 200

It is obvious that brazing or soldering the surfaces together would provide the lowest thermal resistance across these joints by filling the interface area with a high thermal conductivity metallic filler. In most applications, however, this is not feasible due to differing metals (and consequently different thermal expansion coefficients) and replaceability problems. Therefore, it is important that the design engineer pay strict attention to the use of the tools that he has at hand to keep thermal resistance to a minimum. The following are some guidelines that should be observed:

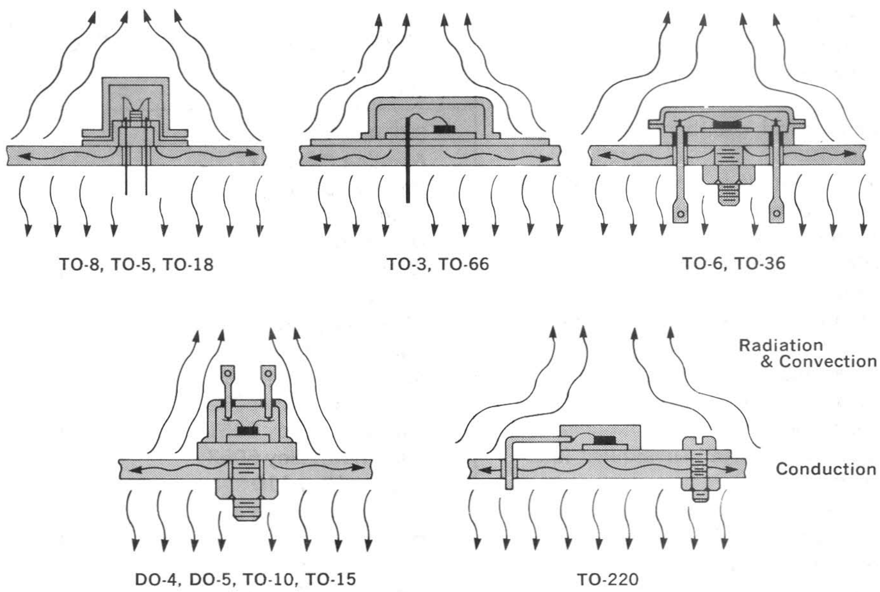

Figure 3

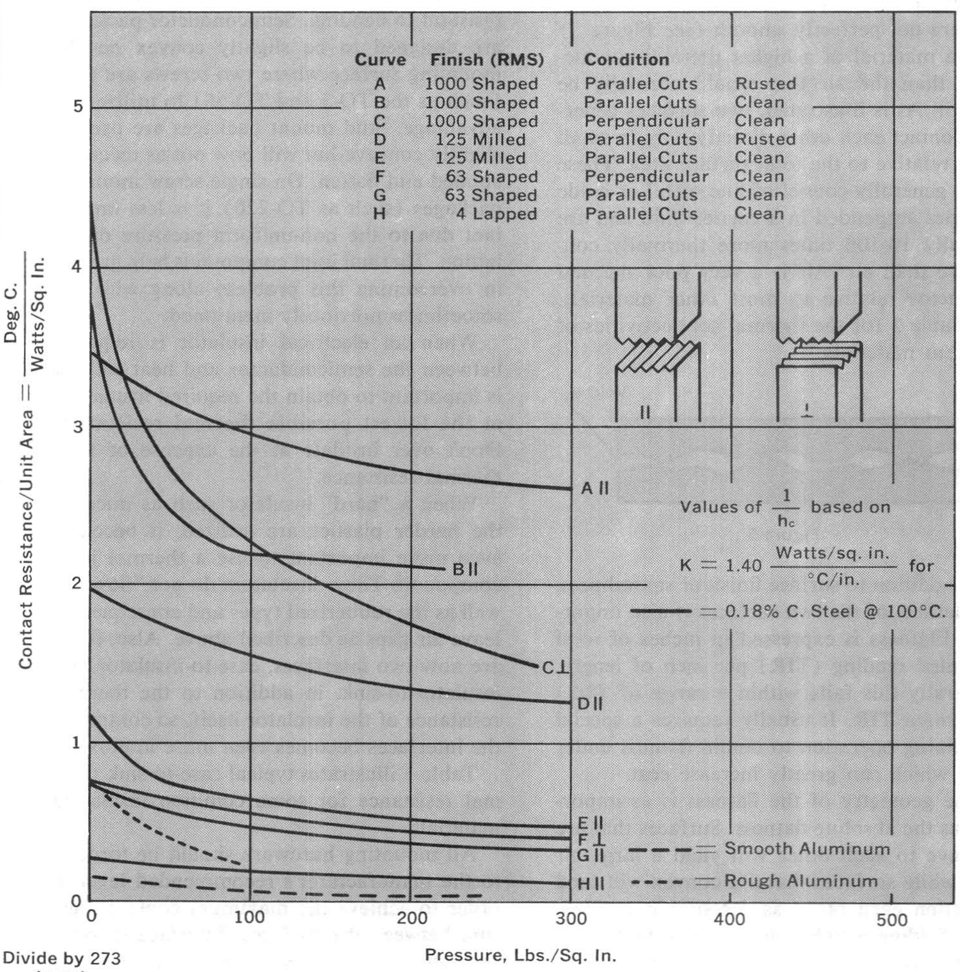

Figure 4

CONTACT RESISTANCE AS A FUNCTION OF CONTACT PRESSURE

Aluminum Alloy 5052	80	3.52
Aluminum Alloy 6061	99	4.36
Aluminum Alloy 6063	111	4.88
Copper Alloy 110	226	9.94
Beryllium Copper 172	62-75	2.7-3.3
Brass Alloy 360	67	2.95
Stainless Steel 321	9.3	.41
Stainless Steel 430	15.1	.66
Steel, Low Carbon C1040	27	1.19
Titanium	4-11.5	.2-.5

terms of interface between semiconductor device and first conduction plane, should obviously be followed for all subsequent interfaces encountered.

In most applications the usual surface finishes encountered are in the 63-125 microinch RMS range. It can be very expensive to produce surface finishes smoother than 63 microinch, so improvement in this area is often not economical. Thermal contact fluids, or joint compounds, can be utilized to reduce the interface thermal resistance by filling in the small voids that occur between surfaces that are not perfectly smooth (see Figure 5) with a material of a higher thermal conductivity than the air that would normally be present. As is illustrated, two surfaces generally contact each other directly only in small areas relative to the total surface area. These fillers generally consist of fine metal or oxide particles suspended in a carrier fluid and are typically 10-100 times more thermally conductive than air. Air is a very poor thermal conductor relative to most other materials. See Table 2 for the thermal conductivities of different materials.

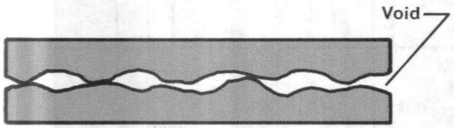

Figure 5

In addition to surface finish or smoothness, the flatness of the two surfaces is also important. Flatness is expressed in inches of total indicated reading (TIR) per inch of length. Generally this falls within a range of .005 - .008 in/in TIR. It usually requires a special machining operation to obtain flatness under .005, which can greatly increase cost.

The geometry of the flatness is as important as the absolute flatness. Surfaces that are concave to each other will yield a large air gap, while surfaces that are convex will tend to flatten each other as pressure is applied, thus yielding a tight, efficient interface. This is a very prevalent phenomenon with stamped metal heat sinks made of relatively thin material. It becomes less noticeable in extruded heat sinks where the material at the mounting interface tends to be relatively thick and more resistant to bending. Semiconductor packages are designed to be slightly convex on the mounting surface where two screws are used (such as the TO-3 and TO-66) to utilize this advantage. Stud mount packages are usually slightly concave but will bow out as torque is applied and flatten. On single screw mounted packages (such as TO-220) it is less important due to the non-uniform pressure distribution. Thermal joint compounds help greatly in overcoming this problem along with the smoothness previously mentioned.

When an electrical insulator is required between the semiconductor and heat sink, it is important to obtain the required insulation at the lowest possible thermal resistance. Don't over insulate at the expense of high thermal resistance.

When a "hard" insulator such as mica or the harder plastics are utilized, it becomes even more important to use a thermal joint compound. These insulators do not "flow" as well as the rubberized types and consequently leave air gaps as described above. Also, there are now two interfaces, case-to-insulator and insulator-to-sink, in addition to the thermal resistance of the insulator itself, so control of the interfaces becomes even more important.

Table 3 illustrates typical case-to-sink thermal resistance for some common insulating materials.

All mounting hardware should be torqued to the manufacturer's recommended level in order to achieve the maximum contact pressure between the surfaces. Interface thermal resistance can be greatly reduced, especially in the lower contact pressure ranges (10-100 psi) common in mounting semiconductor devices (as shown in Figure 4) by using proper torque. This is probably one of the most cost-effective measures in reducing interface thermal resistance since it is very easily controlled. It also allows for repeatable interface resistance values. See Table 4 for recommended torque values for different hardware types.

One important assembly operation that is commonly overlooked is the need to retorque the mounting hardware after a flow or wave solder operation where the entire circuit board has been brought to an elevated temperature and then cooled. This thermal cycling usually reduces the torque and is especially noticeable when there are solder lands around the screw holes. Here the solder melts and can flow out from under the mounting hardware due to the pressure. These factors can cause the hardware to be substantially below the recommended torque after soldering even though it was properly torqued prior to soldering. As noted above, torque is one of the least costly and most efficient means of reducing interface thermal resistance.

$\theta_{s\text{-}a}$: Heat Sink Thermal Resistance

It is important to note that there can never be a single thermal resistance value for a heat sink, only a value derived from a given set of conditions. As Figure 6 illustrates, heat sink thermal resistance decreases with a rise in operating power (and, consequently, rising heat sink temperature). Airflow also can have a significant impact in reducing thermal resistance, even at low velocity by increasing the heat transfer efficiency from the sink to the air.

For these reasons, heat sink thermal resistance numbers should be treated with care. The best way to determine a heat sink resis-

tion. These transfer modes are all taken into account in the dissipator thermal resistance figures discussed above in their proper relationship since they derive from empirical testing. However, in order to gain an insight into how heat is actually transferred from the transistor to the ambient air, these modes will be discussed as they are encountered.

1. Conduction

The first mode encountered is that of conduction of the heat through the material of the heat sink from the transistor interface area to the major heat dissipating areas of the heat sink, either fingers or fins. Failure to optimize the material and heat flow geometry can result in the case running hotter, and the sink cooler, than anticipated.

Conduction of heat through a length of material is stated in Fourier's law. Expressed mathematically, Fourier's law reads:

$$\frac{dQ}{dt} = KA \frac{dT}{dL} \qquad (4)$$

which can be reduced to $Q = \frac{KA \Delta T}{L}$ (5) when a steady state condition has been achieved.

From the equation it is evident that heat conduction is directly proportional to the thermal conductivity of the material (K); the cross-sectional area of the flow path (A) and the temperature differential (Δ T) along the material; and, inversely proportional to the length (L). The variation of K with temperature can be neglected within the limits of environmental conditions relevant to electronic packages. This equation can also be used to determine θ_{c-s} where a filler of known thermal conductivity is used.

The following rules should then apply in order to optimize the transfer of heat by conduction:

1. Use materials that have the highest thermal conductivity consistent with structural considerations, price and availability.
2. Utilize an optimum cross-sectional area. For example, the use of too thin a section of aluminum can result in a "choking-off" of the heat flux.
3. Maintain T_2 (where $\Delta T = T_1 - T_2$) at as low a value as possible.
4. Keep the thermal path (L) as short as possible.

	.0057	TO-220	3	5.2
Plastic (Kapton)[1]	.002	TO-3	8	0.8
	.002	TO-66	6	1.6
	.002	TO-220	3	5.2
Insulube 448®	.0039	TO-3	8	0.9
	.0039	TO-66	6	1.8
	.0039	TO-220	3	5.9
Filled Elastomers*	.010	TO-3	8	0.4 to 1.0
	.010	TO-66	6	0.8 to 2.0
	.0095	TO-220	3	2.6 to 6.5
Silicone Rubber*	.012	TO-3	8	1.2
	.012	TO-66	6	2.4
	.012	TO-220	3	7.9
Bare Device	—	TO-3	8	0.15 to 0.25
	—	TO-66	6	0.35 to 0.45
	—	TO-220	3	0.55 to 0.65

*Thermal joint compound not used.

[1]Registered Trademark — DuPont de Nemours Inc.

Table 4
SUGGESTED MAXIMUM TORQUE VALUES FOR FASTENERS OF DIFFERENT MATERIALS

Bolt Size	Low Carbon Steel	18-8 St. St.	Brass	Silicon Bronze	Aluminum 24ST-4	316 St. St.	Monel
	in.-lbs.	in.-lbs.	in.-lbs.	in.-lbs.	in.-lbs.	in.-lbs.	in.-lbs.
2-56	2.2	2.5	2.0	2.3	1.4	2.6	2.5
2-64	2.7	3.0	2.5	2.8	1.7	3.2	3.1
3-48	3.5	3.9	3.2	3.6	2.1	4.0	4.0
3-56	4.0	4.4	3.6	4.1	2.4	4.6	4.5
4-40	4.7	5.2	4.3	4.8	2.9	5.5	5.3
4-48	5.9	6.6	5.4	6.1	3.6	6.9	6.7
5-40	6.9	7.7	6.3	7.1	4.2	8.1	7.8
5-44	8.5	9.4	7.7	8.7	5.1	9.8	9.6
6-32	8.7	9.6	7.9	8.9	5.3	10.1	9.8
6-40	10.9	12.1	9.9	11.2	6.6	12.7	12.3
8-32	17.8	19.8	16.2	18.4	10.8	20.7	20.2
8-36	19.8	22.0	18.0	20.4	12.0	23.0	22.4
10-24	20.8	22.8	18.6	21.2	13.8	23.8	25.9
10-32	29.7	31.7	25.9	29.3	19.2	33.1	34.9
1/4"-20	65.0	75.2	61.5	68.8	45.6	78.8	85.3
1/4"-28	90.0	94.0	77.0	87.0	57.0	99.0	106.0
5/16"-18	129	132	107	123	80	138	149
5/16"-24	139	142	116	131	86	147	160
3/8"-16	212	236	192	219	143	247	266
3/8"-24	232	259	212	240	157	271	294
7/16"-14	338	376	317	349	228	393	427
7/16"-20	361	400	327	371	242	418	451
1/2"-13	465	517	422	480	313	542	584
1/2"-20	487	541	443	502	328	565	613

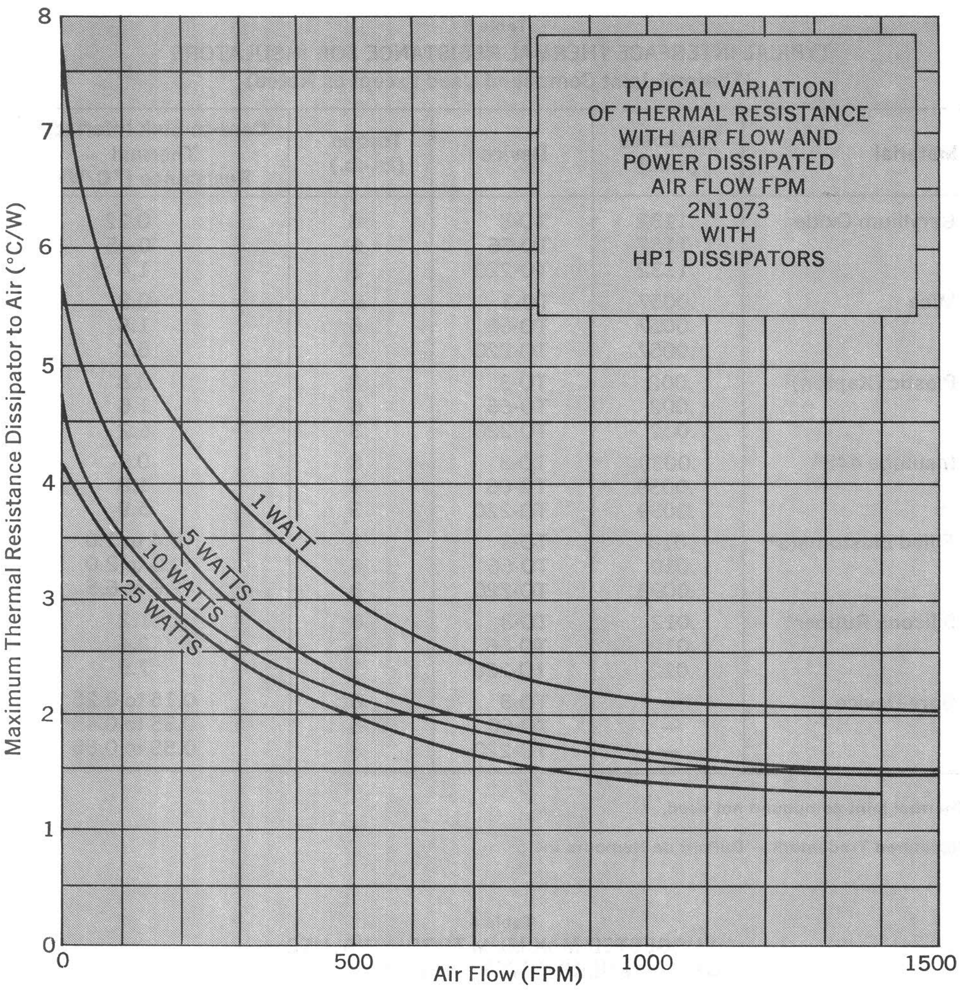

Figure 6

A list of the thermal conductivities for materials typically used in heat transfer applications is provided in Table 2 as guide to the design engineers involved in thermal management.

Copper has the best practical thermal conductivity of available heat transfer materials, but because of material cost, weight, and ease of fabrication, aluminum is used most frequently.

In the case of aluminum, care should be taken in the alloy selection since the conductivity is directly affected by the alloying elements. However, other factors must be considered such as strength, environmental resistance, and cost in arriving at an alloy selection.

Epoxy (even thermally conductive epoxy) has very poor conduction characteristics and should be avoided when other, more efficient means of heat transfer can be employed.

In some applications, such as space, conduction may be the only form of thermal transfer open to the designer to get the heat from the hot spot to the ultimate heat sink. In these cases the heat is conducted from the semiconductor to the card racking structure, chassis, or other point of high thermal mass. Where the mass is large relative to power, these structures can be considered infinite heat sinks.

In these situations it is important to keep the thermal path as short as possible, a factor to consider in the layout of a circuit board.

In most situations, it is the job of the heat dissipator to transfer the unwanted energy to the ambient air.

Once the heat has been conducted from the heat generating component to the major dissipation areas of the heat sink, it is transferred to the ambient by one of two modes: radiation, or radiation with convection.

2. Radiation

Thermal radiation is the transfer of heat by electromagnetic radiation (primarily in the infra-red wavelengths). Radiation is the only means of heat transfer between bodies separated by a complete vacuum as would happen in space environments. Heat transfer by radiation is also more difficult to anaylze than heat transfer by conduction. The rate of heat flow by radiation is a function (among other things) of the emissivity of the surface, the surface area and the fourth power of the absolute temperature differential.

The Stefan-Boltzmann law states that the total energy radiated by a perfect black body is proportional to the fourth power of the absolute temperature differential. For our purposes, this usually takes the form of the equation

$$Q_{rad} = S\,A\,\varepsilon\,\sigma\,(T_1^4 - T_2^4) \qquad (6)$$

In this equation σ represents the Stefan-Boltzmann constant (.0037 in the watt-sec-sq. in. - °K system) while T_1 and T_2 are the temperatures of the hot and cold bodies respectively in °K.

The emissivity (ε) is a derating factor for surfaces which are not black bodies. It is defined as the ratio of emissive power of a given body to that of a "black body" for which the emissivity is unity. Some bodies, such as lampblack, approach unity very closely and are consequently called "black." It should be noted the term has little to do with the color in the optical sense; bodies of any optical color can have high emissivities and be referred to (thermally) as black bodies. (For example, the emissivity of anodized aluminum is the same if it is dyed black, red, blue, etc.) However, it should be noted that a matte or dull surface will be more radiation efficient than a bright, glossy surface.

The surface emissivity of a heat dissipator is dependent to a large degree on the type of surface finish employed. Figure 7 gives a list of surface emissivities frequently encountered in heat dissipators.

The area (A) term must usually be derated by a shielding factor (S) in order to yield the effective surface area. In many designs, and extrusions in particular, the radiant energy emitted by one fin is often reabsorbed by an adjacent fin because radiant energy flows on a path perpendicular to the surface. This energy flow will continue until it is absorbed by air molecules or another surface. Thus, closely spaced fins have little effective radiation area because they merely "bounce" the radiant energy back and forth from fin to fin and S is consequently small in value. S increases as the fins are moved apart, thereby allowing more air molecules to absorb the energy. S = 1.0 and all area is effective when there is no reflecting surface — such as a flat plate suspended in air.

This fact should also be kept in mind during the layout of circuit boards. When a high temperature component is located near a heat dissipator, that heat dissipator will absorb some energy, causing it to run hotter than it normally would.

With the above in mind, the designer can take maximum advantage of radiation by:

1. Use of a heat sink that affords maximum surface area for a given volume. Care should be taken here to be sure that no surfaces of the same heat sink in close proximity are radiating to each other.
2. Keeping surface finishes as highly emissive as possible. Always make sure that

Material and Finish	Emissivity
Aluminum Sheet — Polished	.040
Aluminum Sheet — Rough	.055
Anodized Aluminum — any color	.80
Brass — Commercial	.040
Copper — Commercial	.030
Copper — Machined	.072
Steel — Rolled sheet	.55
Steel — Oxidized	.657
Nickel Plate — Dull Finish	.11
Silver	.022
Tin	.043
Oil Paints — any color	.92-.96
Lacquer — any color	.80-.95
Insulube 448®	.91

Figure 7
NORMAL EMISSIVITY OF VARIOUS SURFACES

the placement of these surfaces are such that they radiate thermal energy, not absorb it from other hotter bodies.

3. Using heat sink materials that will conduct the thermal energy to the dissipating surfaces at as fast a rate as possible in order to keep the temperature differential between dissipating surfaces and air as high as possible.

3. Convection

The third mode of heat transfer is by convection. Heat transfer by convection is the most complex of heat transfer modes. Convection involves the transfer of heat by the mixing of fluids. The rate of heat flow by convection from a solid surface to a fluid is a function of the surface area of the solid in contact with the fluid, the temperature differential between the fluid and the solid, the velocity of the fluid and certain properties of the fluid.

The contact of any fluid (for our purposes, air) with a hotter surface reduces the density of the fluid and causes it to rise. Circulation resulting from this phenomenom is known as free or natural convection. Since the convection mode of heat transfer is closely related to the fluid motion, it is helpful to dwell a moment on the differences and effects of laminar and turbulent flow.

In laminar flow, the air moves in layers, each molecule following a smooth and continuous path called a streamline. The molecules in each layer remain in orderly sequence and do not mix to an appreciable extent across the streamlines. When air flows in a laminar motion along a surface at a temperature different from that of the air, a boundary layer of air exists along the surface and heat is transferred between the air layers primarily by radiation from the warm molecules and by conduction between molecules that come in contact.

In contrast, turbulent flow is characterized by randomly disorganized motion of the air molecules. In turbulent flow the heat transfer method, layer to layer, is aided by innumerable eddies which carry the molecules of air across the streamlines. These air molecules act as carriers of energy and transfer heat by mixing with other particles of the air and by breaking up the boundary layer, allowing cooler air molecules to come into contact with the heat sink more frequently, thus creating an increased temperature differential. Any increase in the turbulence will result in an increase in the rate of heat flow by convection.

The air flow can be induced either by natural convection as described above or by some external means, such as fans or blowers. This latter means of air movement is known as forced convection.

The general equation for convection is usually written

$$Q_{conv} = h\,A\,(T_{surface} - T_{fluid}) \qquad (7)$$

In this equation A is the area of the heat sink and T is, as usual, the temperature. All other variables that affect convection efficiency are considered in the derivation of h (coefficient of convection), or heat transfer per unit area. There are actually three equations for h, the selection of which is predicated upon the Reynolds and Prandtl numbers for the system under given conditions. These numbers are functions of the fluid, flow velocity and flow path. Stated briefly:

$$h = \text{a function of } (f, L, K, g, \beta, \rho, \mu, c_p, V) \qquad (8)$$

f = Friction factor
L = Geometry factor (also known as the significant dimension)
K = Thermal conductivity of the fluid
g = Acceleration due to gravity
β = Coefficient of thermal expansion of the fluid
ρ = Density of the fluid
μ = Viscosity of the fluid
c_p = Specific heat of the fluid
V = Volume of the fluid

There is obviously a great deal to consider when attempting to analyze a natural or forced convection dissipation system. Space does not permit going into great detail of all the phenomena.

Heat transfer by forced convection can be as much as 10 times more efficient than natural convection with a properly designed forced air heat sink. Turbulent airflow usually begins to occur at velocities of approximately 3 feet per second (180 feet per minute) with a concurrent increase in heat transfer. As can be seen in Figure 6, there is as much reduction in thermal resistance by going from still air to 200 fpm as there is in going from 200 fpm to 1000 feet per minute. Also, it has been found that velocities in excess of 1000 fpm do not significantly reduce heat sink thermal resistance. Forced convection is more expensive to attain than natural convection and should be resorted to only when the power levels are so high or space so limited that it precludes the use of natural convection techniques.

Also, in forced convection the effect of heat transfer by radiation is greatly minimized. At sea level conditions heat is transferred by approximately 70% natural convection and 30% radiation in a properly designed natural convection heat sink. When forced convection is used, transfer by radiation can be reduced to a 2 - 7% contribution due to the lower heat sink temperatures and greater convection contribution. In forced air design calculations it is frequent practice to disregard any transfer by radiation because of its relatively small contribution.

When a heat sink is specifically designed for forced air applications, the fins can be moved much closer together since we are no longer concerned with radiative heat transfer within the limits of manufacturability. Aluminum extrusions are basically limited to a fin height not exceeding four times the clear open width at the top of the fins. Other types employ extended surfaces in the form of plates, or very thin convoluted stock, which are generally brazed into an assembly; in the latter instance taking on the appearance of corrugated cardboard when viewed from the edge, though on a larger scale. This is very efficient in terms of surface area per unit volume, but is relatively high in cost.

Other application factors that should be considered in order to maximize the advantages of convective cooling are:

1. In natural convection, mount heat sinks so the maximum length of convection surfaces are in the vertical plane.
2. Mount heat sources low on the heat sink. An exception here would be in the case of high power devices on the same heat sink with low power, temperature sensitive devices. In this case, the low power devices should be located towards the bottom of the heat sink and the high power devices further up.

3. Provide proper enclosure ventilation so as not to impede the natural convection of the air.
4. In forced convection keep low power components upstream, with higher heat generating devices downstream.
5. Duct equipment properly so that optimum pressure heads can be maintained throughout, thereby insuring higher velocities and more efficient heat transfer.
6. Where flat finned heat sinks are used, be sure that the height, length and spacing of the fins are designed to handle the amount of air flow properly. Where possible, spines should be extended into the air flow to create turbulence.

The Effect of Altitude On Radiation and Natural Convection

As discussed above, convection and radiation are the principal means by which heat is transferred to the ambient air. At sea level approximately 70% of the heat is dissipated through convection and only 30% by radiation. However, as altitude increases, the convection factor becomes less effective as the air becomes less dense; at 70,000 feet, 70% to 90% of heat dissipation is by radiation.

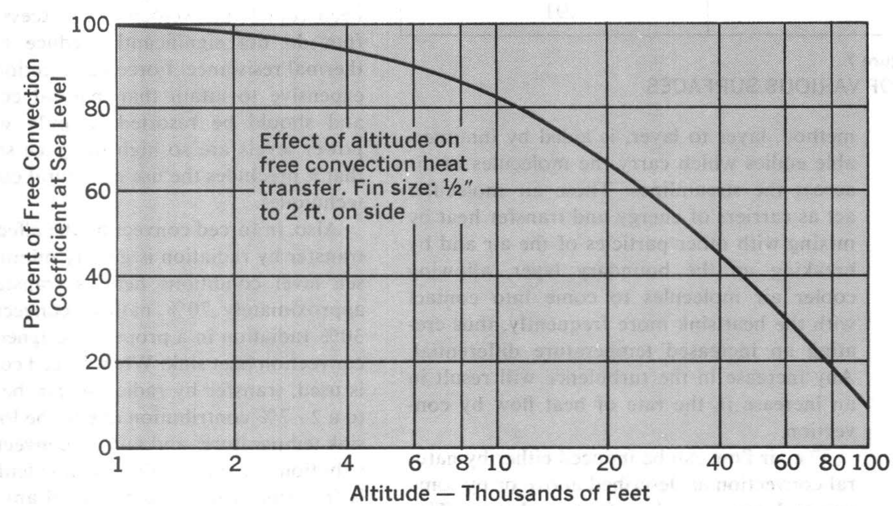

Figure 8

EFFECT OF ALTITUDE ON FREE CONVECTION HEAT TRANSFER

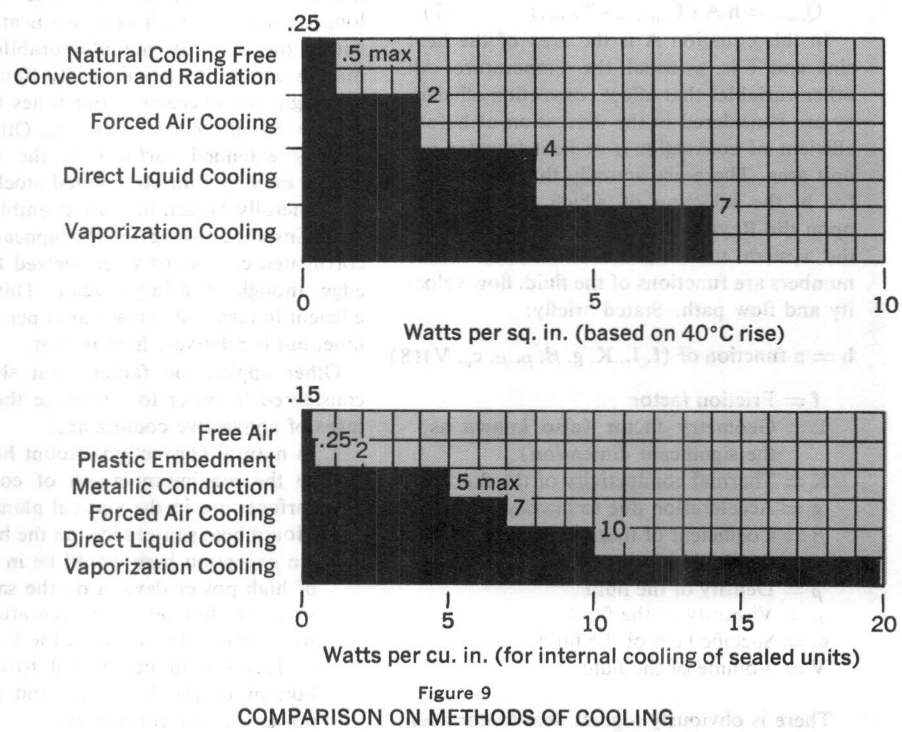

Figure 9

COMPARISON ON METHODS OF COOLING

This factor is very important in aircraft installations and greatly affects heat dissipator design and function when the heat is to be transferred by this method. Figure 8 illustrates typical heat transfer degradation with altitude and can be used to "derate" heat sink values determined at sea level conditions.

Effect of Ambient Temperature

Since air density is directly proportional to temperature, convective heat transfer efficiency is reduced at higher ambient temperature by a thinning out of the air molecules.

As in the case of altitude, adjustment to anticipated convection cooling should be taken into account if equipment is expected to operate over an extreme range of ambient air temperatures.

At ambient temperatures up to approximately 50°C there is usually no need to derate heat sink values derived at 25°C, but the effect of the increased ambient temperature must still be directly applied when determining semiconductor case or junction temperatures (as T_{amb}).

It is important to select an ambient temperature for design work than can be realistically anticipated during the equipment's lifetime. Setting the design ambient too high results in an overly large heat sink; while setting it too low can result in very high device temperatures should the design ambient be exceeded.

A design ambient of 50°C (122°F) is frequently specified in commercial applications and covers the majority of expected ambient conditions. However, where extreme environmental conditions are expected, such as in the engine compartment of an automobile, the design ambient must be increased accordingly. Military requirements usually fall into the latter category with design ambients up to 71°C (160°F) frequently specified.

When a heat sink is utilized within a sealed equipment enclosure, the ambient temperature it encounters is the ambient within the enclosure, which will always be hotter than room ambient conditions.

Other Means of Heat Dissipation

Where very high dissipation levels are encountered, one must move on to higher power dissipation techniques, usually either liquid cooling or vaporization (ebullition) cooling. We will not discuss these in any detail here but the graphs in Figure 9 give an indication of what dissipation levels can be obtained by these methods.

Electronic Equipment Enclosures

Consideration must be taken of the effects of an equipment enclosure on the electronic components housed inside since they have a direct effect on equipment temperature levels. Figure 10 illustrates some typical thermal performance levels that can be obtained for different enclosure designs.

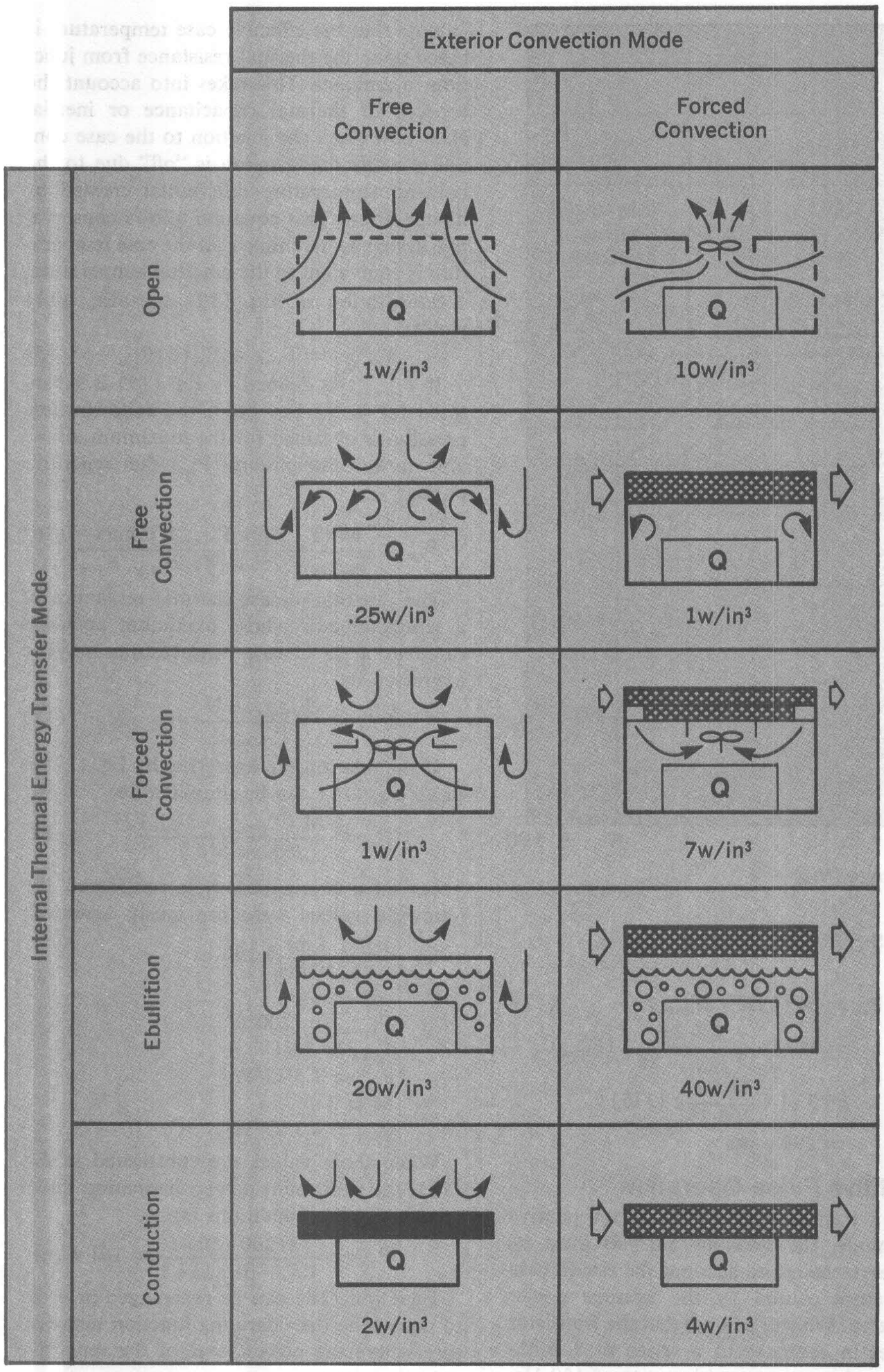

Figure 10
HEAT TRANSFER CAPABILITIES $\Delta T = 40°C$

As is easily seen, proper enclosure ventilation can greatly enhance dissipation capabilities in both natural convection and forced convection. Proper enclosure ventilation allows a four-fold power increase in pure natural convection systems (.25 W/in^3 vs. 1 W/in^3). If the unit must be sealed, the same heat transfer capability can be maintained by external forced air cooling of a properly designed equipment.

Determination of Heat Transfer Requirements

The amount of heat generated by a semiconductor is directly influenced by its mode of operation as well as its power level and efficiency. Whether it is operated in a steady state mode or in a pulse mode can have a significant effect on its heat dissipation requirements. In order to optimize heat dissipator selection, we will now examine the method of heat generation and its relationship to heat sink selection.

Steady State

The power dissipation that can be achieved under steady state conditions depends upon the sum of thermal resistances from the junction to the ultimate heat sink, typically ambient air, the maximum allowable junction temperature, and the ambient temperature. Stated mathematically —

$$P_{ss\ max} = \frac{1}{\theta_{j\text{-}a}} (T_{j\ max} - T_{amb}) \qquad (9)$$

To determine the maximum dissipation of a semiconductor/heat sink system we would need the following inputs:

From the transistor manufacturers data sheet —

$\theta_{j\text{-}c} = 1.5°C/W$ (for a TO-3 in this example)

$T_{j\ max} = 200°C$

From the heat dissipator manufacturers data sheet we determine —

$\theta_{s\text{-}a} = 2.5°C/W$

Assume that $\theta_{c\text{-}s} = 0.3°C/W$ (for a TO-3 mounted with thermal joint compound and no insulator)

Assume that T_{amb} is 50°C

Therefore, $\theta_{j\text{-}a} = 1.5 + 2.5 + 0.3 = 4.3°C/W$

To determine maximum allowable power—

$$P_{ss\ max} = \frac{1}{\theta_{j\text{-}a}} (T_{j\ max} - T_{amb}) = \frac{1}{4.3}(200 - 50) = 34.9 \text{ watts}$$

Note that it often desirable to maintain junction temperatures below the rated maximum in order to gain greater equipment reliability. To do this, merely substitute your maximum design junction temperature for $T_{j\ max}$ in equation 9.

Conversely, we can predict the operating temperature of a device operating at a known power in a device/heat sink system by rearranging the equation to:

$$T_j = (P_{ss\ max})(\theta_{j\text{-}a}) + T_{amb} \qquad (10)$$

Assume a dissipation of 20 watts. From above we have $\theta_{j\text{-}a} = 4.3°C/W$ and an ambient of 50°C. Plugging these values in yields

$$T_j = (20\ W)(4.3°C/W) + 50°C = 136°C$$

Single Pulse Operation

When a transistor is operated in response to a single, non-repetitive, short-duration pulse of power, the maximum allowable dissipation during this transient period is substantially greater than its steady-state dissipation capability.

Let us determine the power dissipation of a transistor in the specified thermal system as defined above for a single 1 millisecond pulse. Before the maximum dissipation can be de-

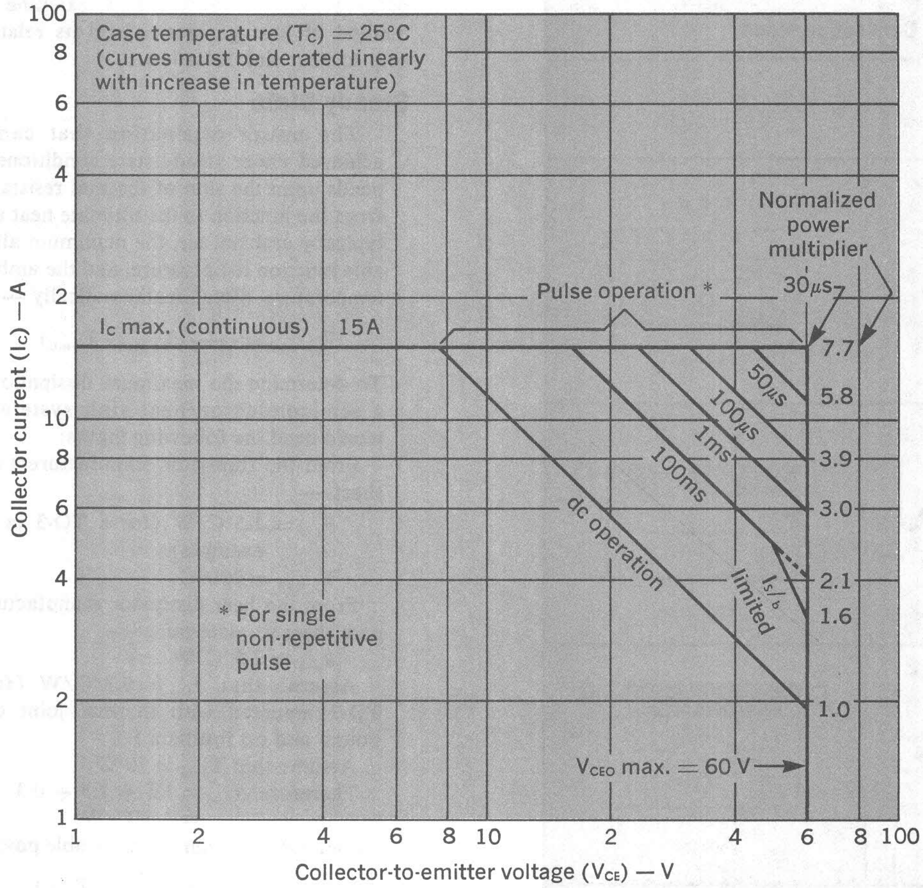

Figure 11
MAXIMUM OPERATING AREAS FOR TYPE 2N3055

termined, the transient thermal characteristics of the transistor must be known. This usually is obtained from the "maximum-operating-area" curve shown on the transistor manufacturer's data sheet (see Figure 11) in the form of a normalized power multiplier (M).

From the graph we see that for a 1 millisecond pulse, the normalized power multiplier for a 2N3055, given for a case temperature of 25°C, is 3. At higher case temperatures, the power multiplier must be linearly derated so that it is reduced to zero at $T_{j(max)}$. The temperature derating factor (TDF) is determined as follows:

$$TDF = 1 - \frac{T_c - 25°C}{T_{j(max)} - 25°C} \qquad (11)$$

For the example specified, the thermal capacitance (C_t) of the heat sink is so large that its temperature rise due to the 1 millisecond pulse will be negligible. The case temperature is, therefore, essentially the same as the ambient (50°C). This information combined with the maximum steady-state dissipation rating ($P_{max} = 115$ watts at $T_c = 25°C$, from the data sheet), can be used to determine the maximum power dissipation for a single 1 millisecond pulse (P_{sp}) in the following manner:

$$P_{sp} = M\ (TDF)\ (P_{max}) \qquad (12)$$

$$= M\ (1 - \frac{T_c - 25}{T_{j(max)} - 25})\ (P_{max})$$

$$= 3\ (1 - \frac{50\text{-}25}{200\text{-}25})\ (115)$$

$$= 296 \text{ watts}$$

Repetitive Pulse Operation

For a transistor operating in a repetitive pulse mode, the previous analysis must be modified to take into account the rise in case temperature caused by the average power dissipation. We will assume that the transistor operates in response to a series of 1 millisecond pulses at a repetition rate of 100 Hz. Assume also the same thermal conditions as described for steady-state and single-pulse operation.

For repetitive-pulse operation, the average power dissipation ($P_{avg.}$) is determined by the following relationship:

$$P_{avg.} = P_{pk}\ (d) \qquad (13)$$

Where:

P_{pk} = peak pulse power
d = duty cycle

The effective T_c that results from this average dissipation is determined from:

$$T_{c(eff)} = T_{amb} + P_{avg}\theta_{j\text{-}a} \qquad (14)$$

Note that the effective case temperature is based upon the thermal resistance from junction to ambient. This takes into account the concept of thermal capacitance or inertia. Heat flow from the junction to the case continues while the junction is "off" due to the built-up temperature differential created by its operation. This equation allows conservative design by assuming that the case temperature is equivalent to the junction temperature.

Substitution of Eq. (13) into Eq. (14) yields:

$$T_{c(eff)} = T_{amb} + P_{pk}(d)\theta_{j\text{-}a} \qquad (15)$$

If $T_{c(eff)}$, as defined by Eq. (15) is substituted for T_c in Eq. (12), the following expression is obtained for the maximum allowable power dissipation (P_{rp}) for repetitive pulses:

$$P_{rp} = \frac{M\ (T_{j(max)} - T_{(amb)})\ P\,max}{T_{j(max)} - 25 + Md\ P_{(max)}\ \theta_{j\text{-}a}} \qquad (16)$$

The junction-to-case thermal resistance of a semiconductor whose maximum power is rated at a 25°C case temperature may be expressed by:

$$\theta_{j\text{-}c} = \frac{T_{j(max)} - 25}{P_{(max)}} \qquad (17)$$

If the relationship expressed by Eq. (17) is used, Eq. (16) can be simplified to:

$$P_{rp} = \frac{M\ (T_{j(max)} - T_{amb})}{\theta_{j\text{-}c} + Md\ \theta_{j\text{-}a}} \qquad (18)$$

For the numerical example considered, the following values were previously assumed:

$$d = (\frac{1\ ms}{10\ ms})\ 100$$
$$= 10\%$$
$$T_{j(max)} = 200°C$$
$$T_{amb} = 50°C$$
$$\theta_{j\text{-}c} = 1.5°C/W$$
$$M = 3$$
$$\theta_{j\text{-}a} = 4.3°C/W$$

When these values are substituted in Eq. (18), the maximum power dissipation under repetitive-pulse conditions is:

$$P_{rp} = \frac{3(200 - 50)}{1.5 + 3(0.1)4.3} = 161 \text{ watts}$$

Equation (18) can be rearranged in order to determine the operating junction temperature where the power level of the repetitive pulse is known.

$$T_{j(rp)} = \frac{P_{rp}}{M}(\theta_{j\text{-}c} + Md\ \theta_{j\text{-}a}) + T_{amb} \qquad (19)$$

Assume an 80 watt pulse at the conditions described above. Substituting these values into the equation we obtain:

$$T_j = \frac{80}{3}(1.5 + (3)\ (.10)\ (4.3)) + 50$$
$$= 124°C$$

Irregular Shaped Repetitive Pulse Operation

When a transistor is subjected to irregulary shaped repetitive pulses, the following pro-

cedure may be used to obtain a conservative design:

The maximum average power for the irregular pulse is calculated on the basis of the pulse width (t_p), the period between the leading edges of successive pulses (t) and the maximum steady-state dissipation $P_{ss(max)}$, as follows:

$$P_{avg.} = P_{ss(max)} \left(\frac{t_p}{t}\right) \qquad (20)$$

This equation can be substituted into equation (15) to give the following:

$$T_{c(eff)} = T_{amb} + P_{ss(max)} \frac{t_p}{t} \theta_{j\text{-}a} \qquad (21)$$

This equation can in turn be substituted into equation (12) as described above in order to determine P_{irp} or T_j.

Conclusion

Once the heat dissipation requirements are known it is usually not difficult to select an appropriate heat sink for any application.

Just remember to close the thermal circuit before closing the electrical circuit. One is as important as the other.

Bibliography

Brown and Marco. *"Introduction to Heat Transfer."* McGraw-Hill, 3rd ed.

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Welsh, James P. *"Design Manual of Natural Methods of Cooling Electronic Equipment."* Cornell Aeronautical Laboratory.

Mantell, Charles L. *"Engineering Materials Handbook."* McGraw-Hill.

Laffin, Joseph P. *"Guidelines to Semiconductor Thermal Management."* IERC.

HEAT SINK/DISSIPATOR INDEX BY PART NUMBER

STANDARD EXTRUDED HEAT SINKS

FABRICATED HEAT DISSIPATORS

CONTINUED

HEAT SINK/DISSIPATOR INDEX BY PART NUMBER

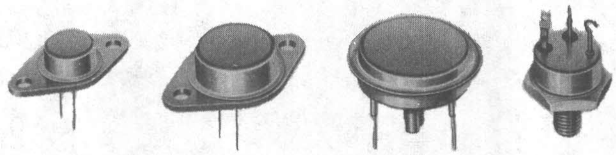
CONTINUED

SECTION 1

HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

SECTION 1

HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS



Determining the appropriate dissipator for a metal case, case-mounted semiconductor (TO-3, TO-15, TO-36, TO-66, DO-4, DO-5, and similar case devices) can be readily accomplished using the two indices illustrated below.

The index on the left is arranged according to increasing power dissipation capability (decreasing thermal resistance), while the index on the right lists dissipators in order of board area requirements and dissipator height.

Using the indices, it becomes a simple matter to locate a number of dissipators with similar, desirable thermal specifications; or to compare respective dimensions to determine the specific dissipator suited to your particular packaging requirements.

All data listed for metal case, case-mounted semiconductors is based on laboratory tests using a 2N3055, TO-3 case device, except for that data on the LA-A and LB series which was obtained using a 2N3054, TO-66 case device. All thermal resistance data contained in these indices (unless otherwise noted) is based on 75°C case temperature rise above ambient in natural convection, and at 50°C case rise above ambient in forced-air at 1000 fpm air velocity.

It is also important to remember that the thermal resistance values listed in the two indices are given for reference only. They are intended to help the engineer "zero in" on a suitable dissipator and should not be used to predict actual thermal performance.

The IERC dissipators illustrated in this section can solve a wide variety of thermal management problems, when they are chosen carefully. Features and detailed descriptions of the individual dissipators are located in the appropriate areas within the section.

In order to select the proper heat dissipator for a particular application, simply follow the formula outlined below to determine the correct part number.

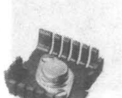
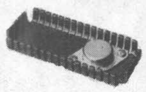
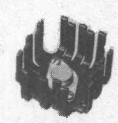
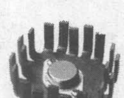
1. Determine maximum anticipated power dissipation.
2. Determine maximum allowable temperature rise by subtracting the maximum ambient temperature (design ambient) from the maximum case temperature you wish to maintain.

   The maximum allowable case temperature may be determined by obtaining the maximum operating junction temperature and the thermal resistance from junction to case (θ_{jc}) from the semiconductor manufacturer's data sheet. The maximum case temperature is the maximum junction temperature minus the product of the thermal resistance junction-to-case and the maximum power dissipation anticipated.

   $$T_c = T_j - \theta_{j\text{-}c} P_{diss}$$

   It is frequent practice to hold the case temperature to less than the maximum allowable temperature in order to increase component reliability. For a more detailed explanation, see "Principles of Thermal Management" in this catalog.
3. Determine allowable thermal resistance from case-to-ambient by dividing allow-

INDEX BY THERMAL RESISTANCE

Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Mounting Envelope LxWxH (inches)	Page
Board-Mounted	LA—A1	28.9	8.1	1.31 x .90 x .25	1-5
	LB66B2	19.7	6.4	1.40 x 1.12 x .31	1-4
	LA—A2	19.7	6.1	1.31 x .90 x .50	1-5
	LB66B1	17.1	5.3	1.40 x 1.12 x .50	1-4
	LA—A3	16.3	4.9	1.31 x .90 x .75	1-6
	LA363B7	16.0	5.6	1.63 x 1.29 x .40¹	1-12
	LA363B2	15.3	5.0	1.63 x 1.29 x .50¹	1-12
	LA—B7	15.0	5.5	1.63 x 1.29 x .40	1-7,9
	LA—A4	14.4	4.5	1.31 x .90 x 1.00	1-6
	LA—B2	14.1	4.6	1.63 x 1.29 x .50	1-7,10
	UP3	13.6	3.9	1.50 x 1.38 x .44	1-14,15
	LA363B3	12.9	4.4	1.63 x 1.29 x .75¹	1-13
Board-Mounted (cont.)	LA—B3	12.0	3.7	1.63 x 1.29 x .75	1-8,10
	LA363B4	11.2	3.9	1.63 x 1.29 x 1.00¹	1-13
	LA363B5	11.1	3.9	1.63 x 1.29 x 1.25¹	1-14
	UP1	10.4	3.2	1.78 x 1.78 x .50	1-15,16
	LA—B4	10.3	3.2	1.63 x 1.29 x 1.00	1-8,11
	LA—B5	9.3	2.9	1.63 x 1.29 x 1.25	1-9,11
	UP10	8.7	2.9	3.38 x 1.40 x .44	1-19
	UP2	8.3	2.7	1.78 x 1.78 x .75	1-16,17
	UP10—2³	7.7	2.0	3.38 x 1.40 x .44	1-18
	UP	7.1	2.5	1.78 x 1.78 x 1.00	1-17,18
	HP1²	5.4	2.1	2.50 x 2.50 x .90	1-19—1-21
	HP3²	4.4	1.8	3.13 x 3.13 x 1.00	1-21—1-25
	HP3/HP1	3.6	1.6	3.13 x 3.13 x 1.00	1-25

Notes: ¹ Add thickness of TO-3 flange to determine actual height.
² Dissipator will accommodate more than one device. Please see ordering information and technical data on multiple device mounting on pages following this part in the catalog.
³ Dissipator accommodates two transistors. Thermal resistance figures based on average temperature rise divided by total power dissipated.

able temperature rise by the maximum power dissipation (°C/W).

4. Determine whether you wish to mount two or more semiconductors on one sink for thermal matching and space utilization. One dissipator for two semiconductors often uses less space than two heat sinks.
5. Will the dissipator be used in natural convection or forced air — if so, at what velocity? Dissipator efficiency can be greatly increased when forced air is used (See index, this page).
6. Select a dissipator from the thermal resistance table below and turn to page indicated. From the graph of case temperature rise above ambient determine actual case temperature for given power dissipation. You will note that heat dissipator thermal resistance can vary with power level and dissipator temperature. Is this temperature rise acceptable? If not, consult the Thermal Resistance Index to find a dissipator with a slightly lower thermal resistance. If you must maintain a specific board area requirement select a more effective, i.e., taller dissipator from the Index by Board Area and then make your final selection based upon the performance curves supplied for each part in the catalog.
7. From the ordering information select the hole pattern (if applicable) and finish desired. Note that an unplated part will run hotter than a black anodized part in natural convection by the amount given in the rating factors.

Other factors regarding dissipator efficiency and selection parameters are covered in "Principles of Thermal Management."

The following example illustrates this simple procedure:

Problem: To cool a TO-3 case transistor that will dissipate 12.5 watts. From the transistor data sheet we determine that:

$T_{J\ max.} = 200°C$ and $\theta_{J\text{-}c} = 1.0$ °C/W

$$\text{Max. Case Temp.} = 200°C - (1.0)(12.5) = 187.5°C$$

For increased reliability and a safety factor, we set the design case temperature at 150°C. A design ambient of 75°C is set. Therefore, max. allowable temperature rise is 75°C. This makes the max. allowable thermal resistance

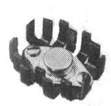
$$\frac{75°C}{12.5W} = 6.0\ °C/W.$$

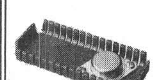
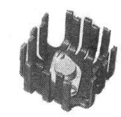
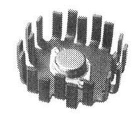
We will assume that 200 fpm of forced air is available. In the Index by Thermal Resistance, values are listed for natural convection and for forced air at 1000 fpm. Just to give us some idea of which performance curves to look at, we will assume that the thermal resistance for a dissipator with 200 fpm of forced air will fall half way between the natural convection and forced air values given. In looking down the Index by Thermal Resistance, the UP1-TO3, LATO3B5, LATO3B4 and LATO3B3 dissipators deserve consideration. Turning to pages 1-15, 1-9, 1-8, and 1-8 respectively, we find that our approximation was very close, because the case rise above ambient for these dissipators with 200 fpm of air flow and 12.5 watts power dissipation is:

72°C	UP1-TO3
62°C	LATO3B5
70°C	LATO3B4
80°C	LATO3B3

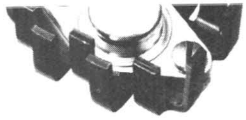
The UP1-TO3 and LATO3B4 offer performance which is closest to our design value. Final selection of a dissipator can now be made based on dissipator size vs. board area and height. Assuming that overall height was our most pressing constraint we would then select the UP1-TO3, and if a commercial black finish was desired the complete part number would be UP1-TO3-CB.

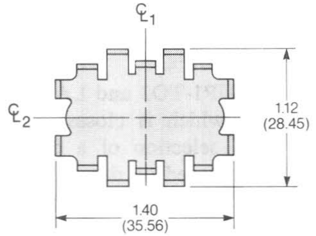
INDEX BY BOARD AREA REQUIREMENTS

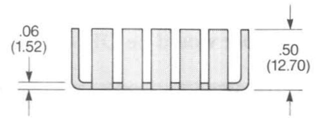
Heat Dissipator Configuration	Part Series	Mounting Envelope LxWxH (inches)	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page
Board-Mounted	LA—A1	1.31 x .90 x .25	28.9	8.1	1-5
	LA—A2	1.31 x .90 x .50	19.7	6.1	1-5
	LA—A3	1.31 x .90 x .75	16.3	4.9	1-6
	LA—A4	1.31 x .90 x 1.00	14.4	4.5	1-6
	LB66B2	1.40 x 1.12 x .31	19.7	6.4	1-4
	LB66B1	1.40 x 1.12 x .50	17.1	5.3	1-4
	UP3	1.50 x 1.38 x .44	13.6	3.9	1-14,15
	LA—B7	1.63 x 1.29 x .40	15.0	5.5	1-7,9
	LA—B2	1.63 x 1.29 x .50	14.1	4.6	1-7,10
	LA—B3	1.63 x 1.29 x .75	12.0	3.7	1-8,10
	LA—B4	1.63 x 1.29 x 1.00	10.3	3.2	1-8,11
	LA—B5	1.63 x 1.29 x 1.25	9.3	2.9	1-9,11

Heat Dissipator Configuration	Part Series	Mounting Envelope LxWxH (inches)	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page
Board-Mounted (cont.)	LA363B7	1.63 x 1.29 x .40[1]	16.0	5.6	1-12
	LA363B2	1.63 x 1.29 x .50[1]	15.3	5.0	1-12
	LA363B3	1.63 x 1.29 x .75[1]	12.9	4.4	1-13
	LA363B4	1.63 x 1.29 x 1.00[1]	11.2	3.9	1-13
	LA363B5	1.63 x 1.29 x 1.25[1]	11.1	3.9	1-14
	UP1	1.78 x 1.78 x .50	10.4	3.2	1-15,16
	UP2	1.78 x 1.78 x .75	8.3	2.7	1-16,17
	UP	1.78 x 1.78 x 1.00	7.1	2.5	1-17,18
	UP10	3.38 x 1.40 x .44	8.7	2.9	1-19
	UP10—2[3]	3.38 x 1.40 x .44	7.7	2.0	1-18
	HP1[2]	2.50 x 2.50 x .90	5.4	2.1	1-19—1-21
	HP3[2]	3.13 x 3.13 x 1.00	4.4	1.8	1-21—1-25
	HP3/HP1	3.13 x 3.13 x 1.00	3.6	1.6	1-25

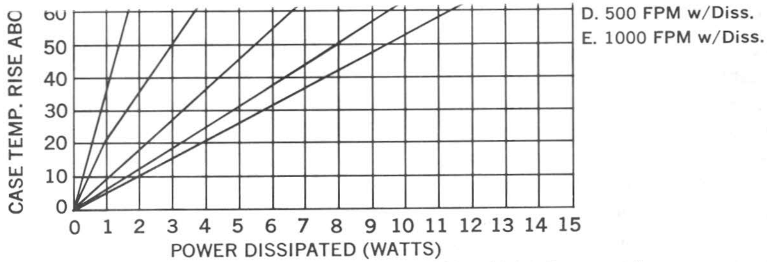
Notes: [1] Add thickness of TO-3 flange to determine actual height.
[2] Dissipator will accommodate more than one device. Please see ordering information and technical data on multiple device mounting on pages following this part in the catalog.
[3] Dissipator accommodates two transistors. Thermal resistance figures based on average temperature rise divided by total power dissipated.







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



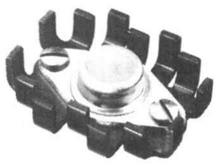
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 1.4 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

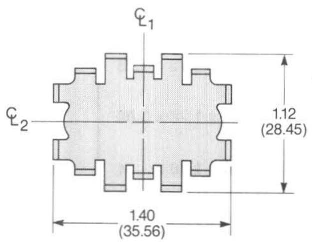
Ordering Information

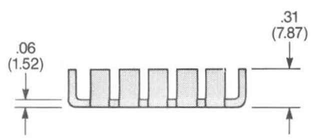
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
LB66B1-76U	LB66B1-76CB	LB66B1-76B	LB66B1-76	Undrilled	—	6.2
LB66B1U	LB66B1CB	LB66B1B	LB66B1	TO-66	9	6.2
LB66B1-67U	LB66B1-67CB	LB66B1-67B	LB66B1-67	TO-66 IC	7	6.2
LB66B1-77U	LB66B1-77CB	LB66B1-77B	LB66B1-77	TO-66 IC (Socket)	10	6.2

Note: See page iv for other finishes.

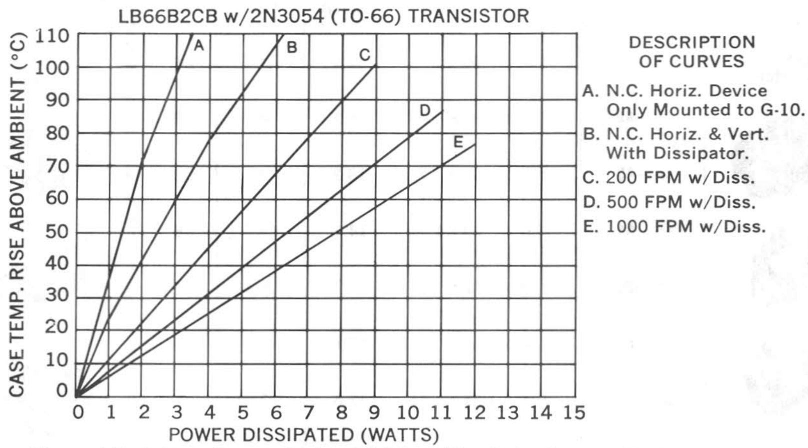
LB66B2 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



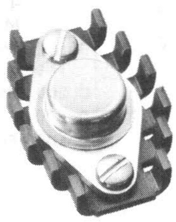
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 1.4 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

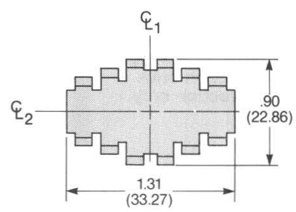
Ordering Information

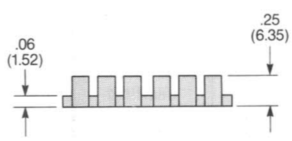
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
LB66B2-76U	LB66B2-76CB	LB66B2-76B	LB66B2-76	Undrilled	—	4.8
LB66B2U	LB66B2CB	LB66B2B	LB66B2	TO-66	9	4.8
LB66B2-67U	LB66B2-67CB	LB66B2-67B	LB66B2-67	TO-66 IC	7	4.8
LB66B2-77U	LB66B2-77CB	LB66B2-77B	LB66B2-77	TO-66 IC (Socket)	10	4.8

Note: See page iv for other finishes.

LA-A1 Series

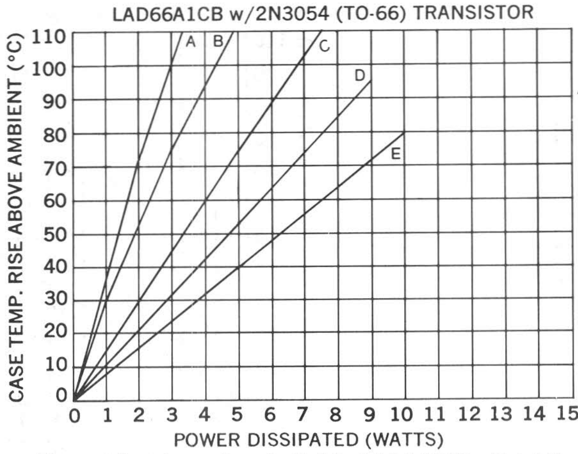






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAD66A1CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

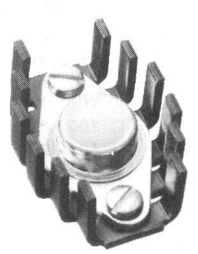
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 0.3 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

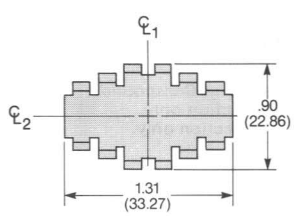
Ordering Information

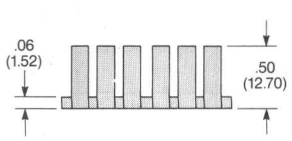
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000A1U	LA000A1CB	LA000A1B	LA000A1	Undrilled	—	3.1
LAD66A1U	LAD66A1CB	LAD66A1B	LAD66A1	TO-66	1	3.1
LAIC66A1U	LAIC66A1CB	LAIC66A1B	LAIC66A1	TO-66 IC	7	3.1

Note: See page iv for other finishes.

LA-A2 Series

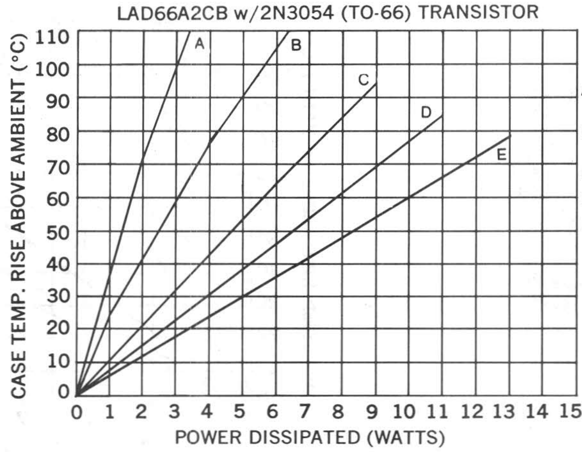






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAD66A2CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

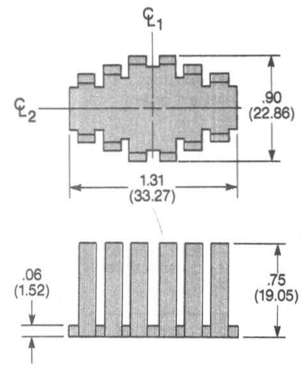
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 0.4 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000A2U	LA000A2CB	LA000A2B	LA000A2	Undrilled	—	4.6
LAD66A2U	LAD66A2CB	LAD66A2B	LAD66A2	TO-66	1	4.6
LAIC66A2U	LAIC66A2CB	LAIC66A2B	LAIC66A2	TO-66 IC	7	4.6

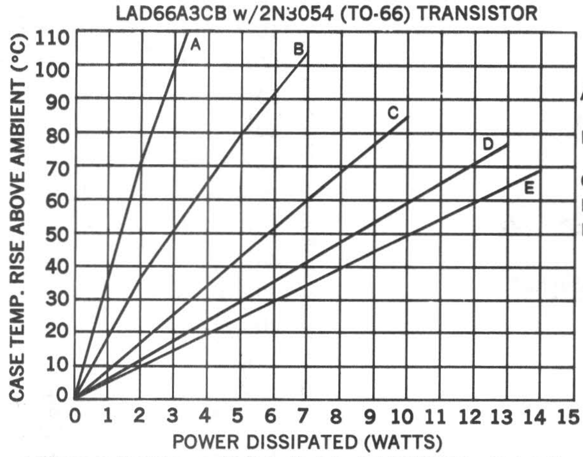
Note: See page iv for other finishes.

LA-A3 Series



Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAD66A3CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES
A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

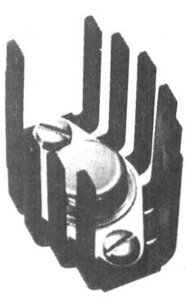
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

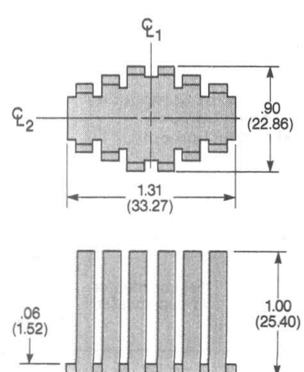
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000A3U	LA000A3CB	LA000A3B	LA000A3	Undrilled	—	6.1
LAD66A3U	LAD66A3CB	LAD66A3B	LAD66A3	TO-66	1	6.1
LAIC66A3U	LAIC66A3CB	LAIC66A3B	LAIC66A3	TO-66 IC	7	6.1

Note: See page iv for other finishes.

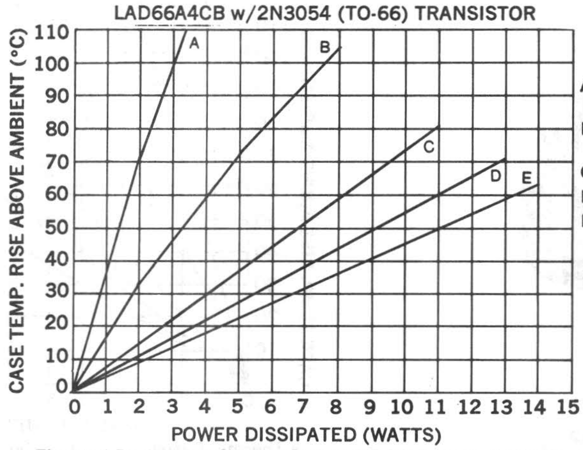
LA-A4 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAD66A4CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES
A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

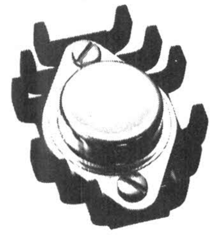
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

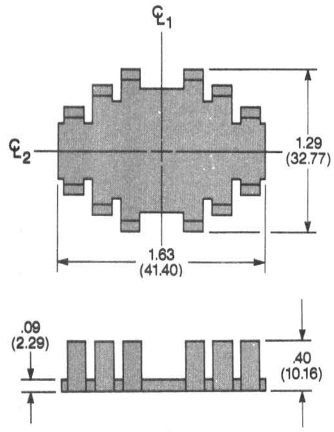
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000A4U	LA000A4CB	LA000A4B	LA000A4	Undrilled	—	7.6
LAD66A4U	LAD66A4CB	LAD66A4B	LAD66A4	TO-66	1	7.6
LAIC66A4U	LAIC66A4CB	LAIC66A4B	LAIC66A4	TO-66 IC	7	7.6

Note: See page iv for other finishes.

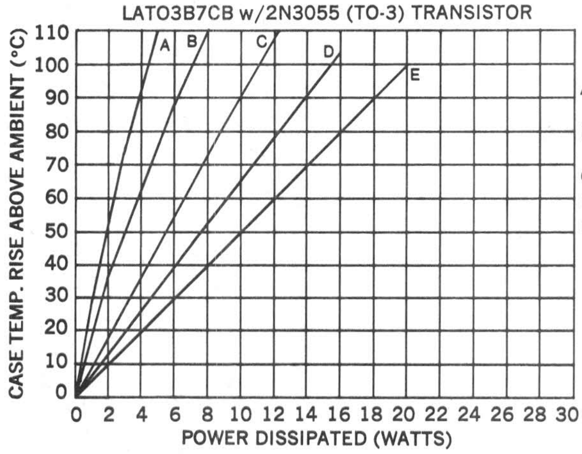
LA-B7 Series for TO-3 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LATO3B7CB w/2N3055 (TO-3) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

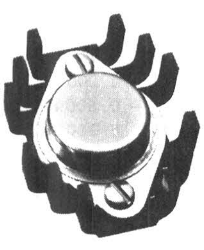
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

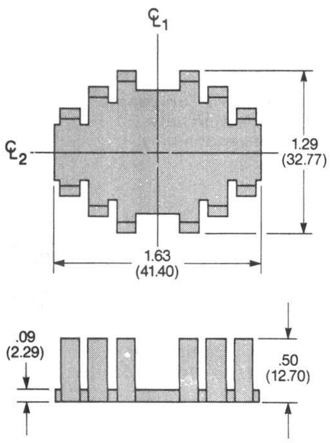
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B7U	LA000B7CB	LA000B7B	LA000B7	Undrilled	—	7.8
LATO3B7U	LATO3B7CB	LATO3B7B	LATO3B7	TO-3	2	7.8
LAIC3B7U	LAIC3B7CB	LAIC3B7B	LAIC3B7	TO-3 IC	4	7.8
LA407B7U	LA407B7CB	LA407B7B	LA407B7	TO-3 (4-pin)	5	7.8
LA394B7U	LA394B7CB	LA394B7B	LA394B7	Universal	8	7.8

Note: See page iv for other finishes.

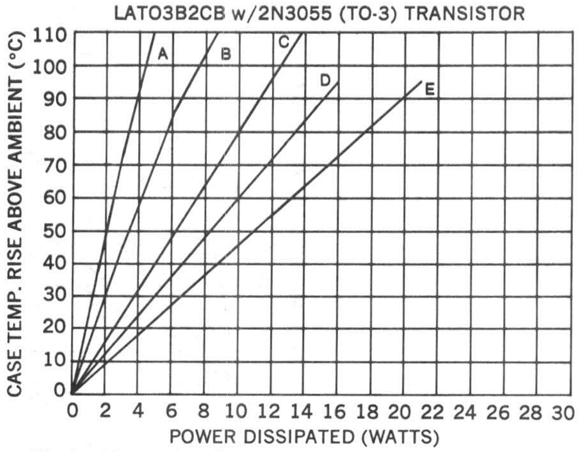
LA-B2 Series for TO-3 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LATO3B2CB w/2N3055 (TO-3) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

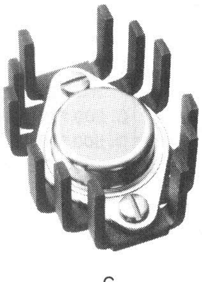
Ordering Information

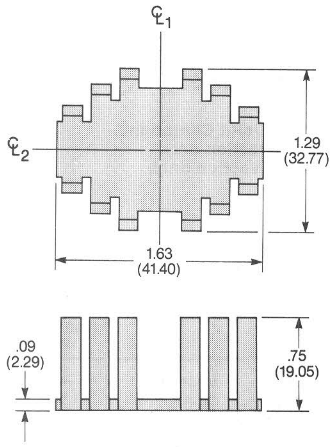
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B2U	LA000B2CB	LA000B2B	LA000B2	Undrilled	—	8.8
LATO3B2U	LATO3B2CB	LATO3B2B	LATO3B2	TO-3	2	8.8
LAIC3B2U	LAIC3B2CB	LAIC3B2B	LAIC3B2	TO-3 IC	4	8.8
LA407B2U	LA407B2CB	LA407B2B	LA407B2	TO-3 (4-pin)	5	8.8
LA394B2U	LA394B2CB	LA394B2B	LA394B2	Universal	8	8.8

Note: See page iv for other finishes.

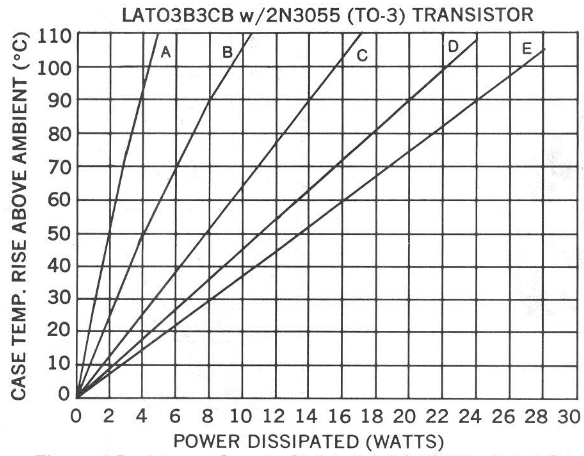
HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

LA-B3 Series for TO-3 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

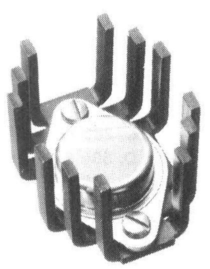
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

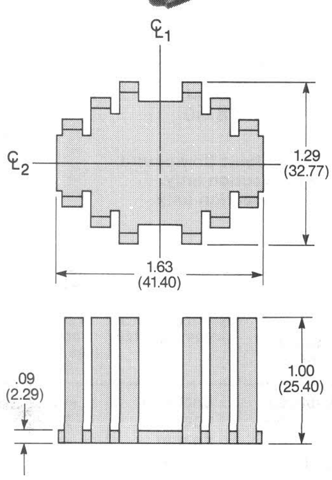
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B3U	LA000B3CB	LA000B3B	LA000B3	Undrilled	—	10.8
LAT03B3U	LAT03B3CB	LAT03B3B	LAT03B3	TO-3	2	10.8
LAICB3U	LAIC3B3CB	LAIC3B3B	LAIC3B3	TO-3 IC	4	10.8
LA407B3U	LA407B3CB	LA407B3B	LA407B3	TO-3 (4-pin)	5	10.8
LA394B3U	LA394B3CB	LA394B3B	LA394B3	Universal	8	10.8

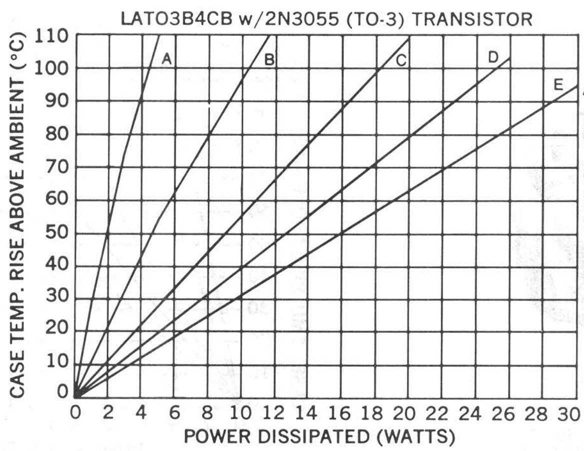
Note: See page iv for other finishes.

LA-B4 Series for TO-3 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

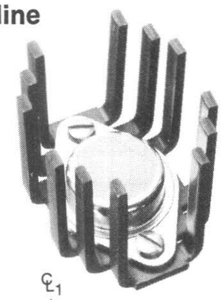
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

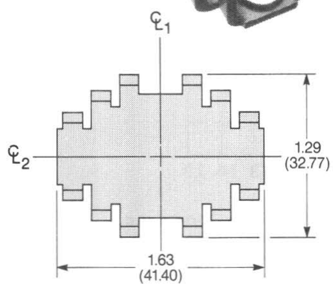
Ordering Information

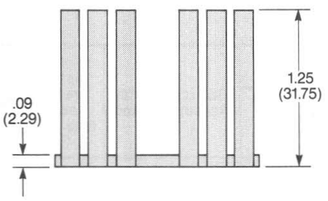
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B4U	LA000B4CB	LA000B4B	LA000B4	Undrilled	—	12.9
LAT03B4U	LAT03B4CB	LAT03B4B	LAT03B4	TO-3	2	12.9
LAIC3B4U	LAIC3B4CB	LAIC3B4B	LAIC3B4	TO-3 IC	4	12.9
LA407B4U	LA407B4CB	LA407B4B	LA407B4	TO-3 (4-pin)	5	12.9
LA394B4U	LA394B4CB	LA394B4B	LA394B4	Universal	8	12.9

Note: See page iv for other finishes.

LA-B5 Series
for TO-3 Outline

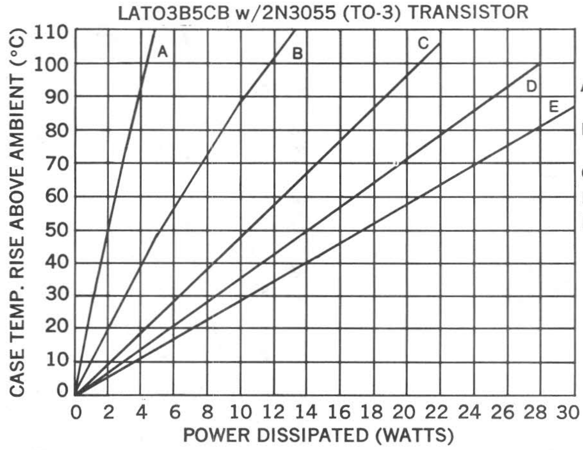






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAT03B5CB w/2N3055 (TO-3) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

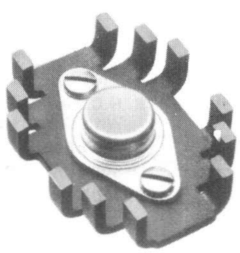
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

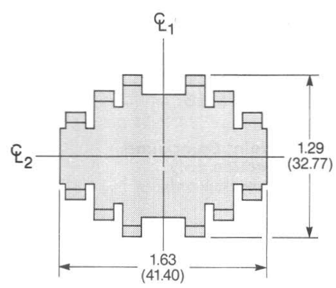
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B5U	LA000B5CB	LA000B5B	LA000B5	Undrilled	—	15.1
LAT03B5U	LAT03B5CB	LAT03B5B	LAT03B5	TO-3	2	15.1
LAIC3B5U	LAIC3B5CB	LAIC3B5B	LAIC3B5	TO-3 IC	4	15.1
LA407B5U	LA407B5CB	LA407B5B	LA407B5	TO-3 (4-pin)	5	15.1
LA394B5U	LA394B5CB	LA394B5B	LA394B5	Universal	8	15.1

Note: See page iv for other finishes.

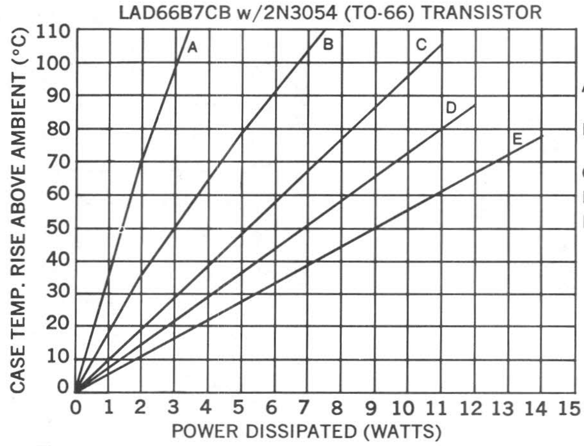
LA-B7 Series
for TO-66 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAD66B7CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.6-0.7 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

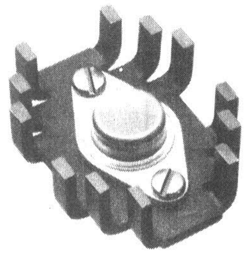
Ordering Information

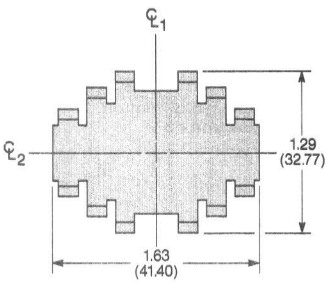
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LAD66B7U	LAD66B7CB	LAD66B7B	LAD66B7	TO-66	1	7.8
LAIC66B7U	LAIC66B7CB	LAIC66B7B	LAIC66B7	TO-66 IC	7	7.8

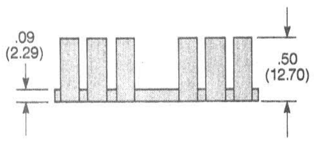
Note: See page iv for other finishes.

HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

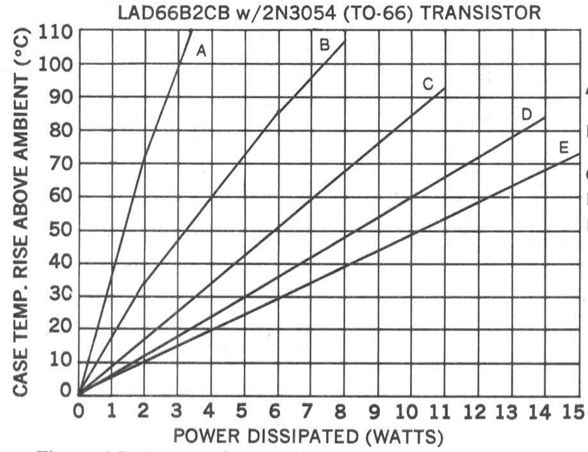
LA-B2 Series for TO-66 Outline







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

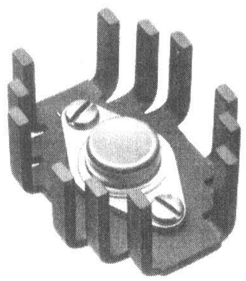
- Thermal Resistance Case to Sink is 0.6-0.7 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

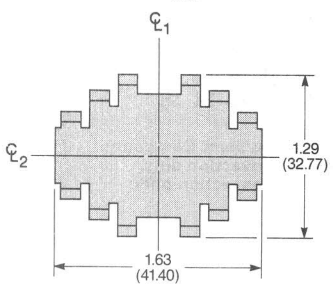
Ordering Information

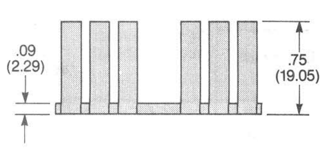
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LAD66B2U	LAD66B2CB	LAD66B2B	LAD66B2	TO-66	1	8.8
LAIC66B2U	LAIC66B2CB	LAIC66B2B	LAIC66B2	TO-66 IC	7	8.8

Note: See page iv for other finishes.

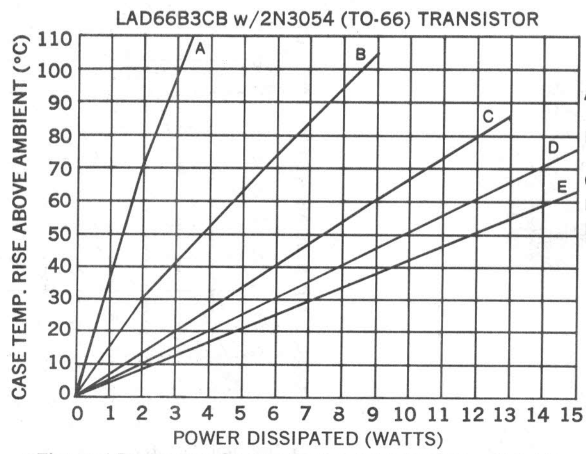
LA-B3 Series for TO-66 Outline







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

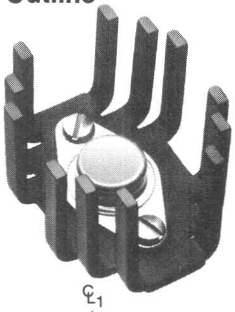
- Thermal Resistance Case to Sink is 0.6-0.7 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

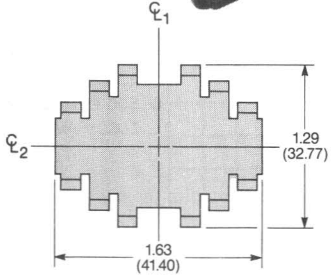
Ordering Information

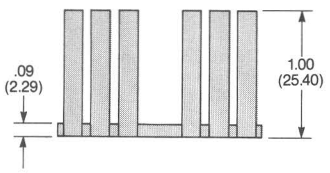
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LAD66B3U	LAD66B3CB	LAD66B3B	LAD66B3	TO-66	1	10.8
LAIC66B3U	LAIC66B3CB	LAIC66B3B	LAIC66B3	TO-66 IC	7	10.8

Note: See page iv for other finishes.

LA-B4 Series
for TO-66 Outline

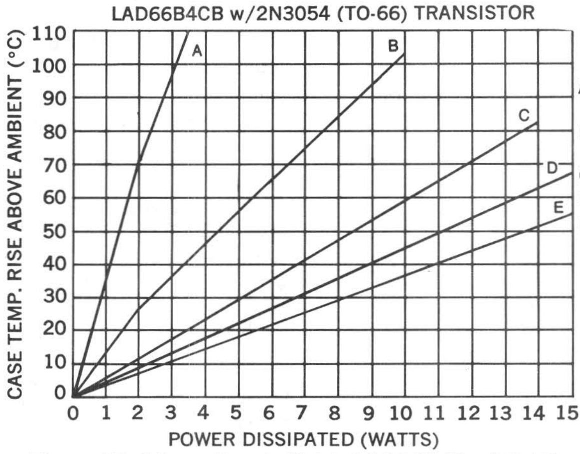






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAD66B4CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES
- A. N.C. Horiz. Device Only Mounted to G-10.
- B. N.C. Horiz. & Vert. With Dissipator.
- C. 200 FPM w/Diss.
- D. 500 FPM w/Diss.
- E. 1000 FPM w/Diss.

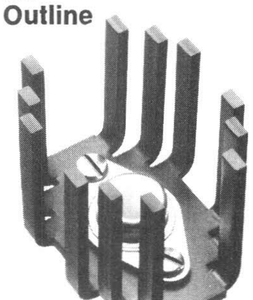
- Thermal Resistance Case to Sink is 0.6-0.7 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

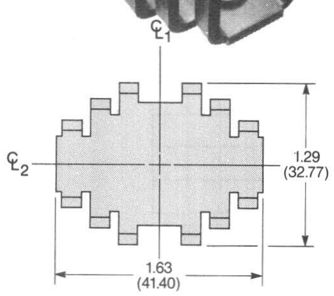
Ordering Information

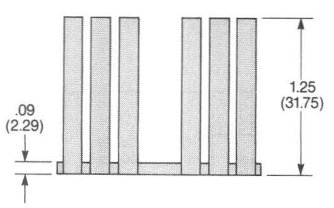
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LAD66B4U	LAD66B4CB	LAD66B4B	LAD66B4	TO-66	1	12.9
LAIC66B4U	LAIC66B4CB	LAIC66B4B	LAIC66B4	TO-66 IC	7	12.9

Note: See page iv for other finishes.

LA-B5 Series
for TO-66 Outline

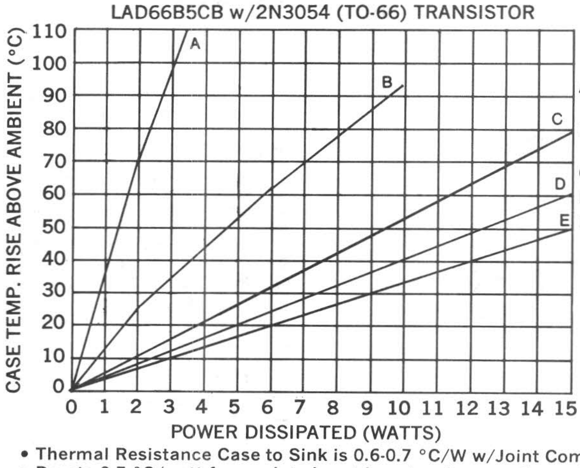






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAD66B5CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES
- A. N.C. Horiz. Device Only Mounted to G-10.
- B. N.C. Horiz. & Vert. With Dissipator.
- C. 200 FPM w/Diss.
- D. 500 FPM w/Diss.
- E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.6-0.7 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LAD66B5U	LAD66B5CB	LAD66B5B	LAD66B5	TO-66	1	15.1
LAIC66B5U	LAIC66B5CB	LAIC66B5B	LAIC66B5	TO-66 IC	7	15.1

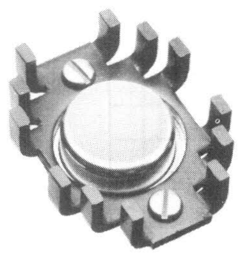
Note: See page iv for other finishes.

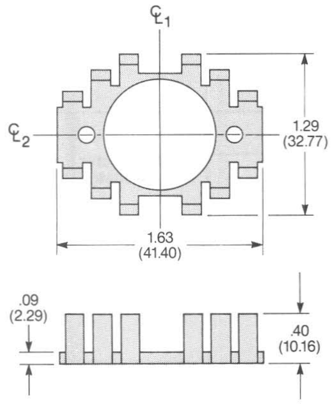
HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

Top-of-flange mounting for TO-3 case types

- Dissipator fits over the TO-3 mounting flange and uses the same hardware that holds the semiconductor in position on the board.
- Requires little board space and can be installed as a retrofit to meet unexpected cooling needs.
- Fits any TO-3 case regardless of pin layout.
- Five finger heights allow optimization of vertical clearance and heat dissipation requirements.

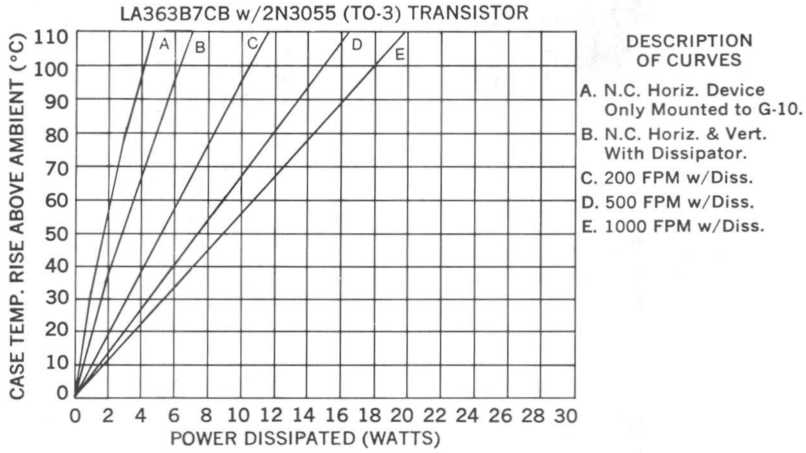
LA363B7





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LA363B7CB w/2N3055 (TO-3) TRANSISTOR



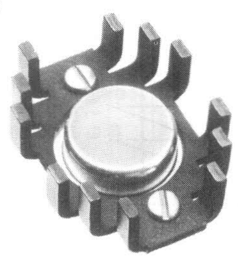
- Thermal Resistance Case to Sink is 1.0-1.4 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

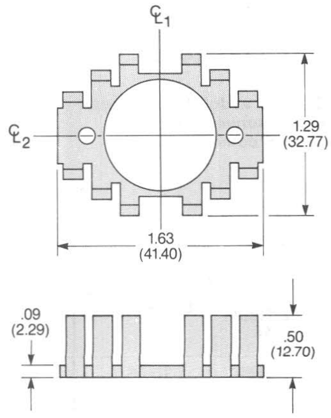
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA363B7U	LA363B7CB	LA363B7B	LA363B7	Any TO-3 can	3	5.3

Note: See page iv for other finishes.

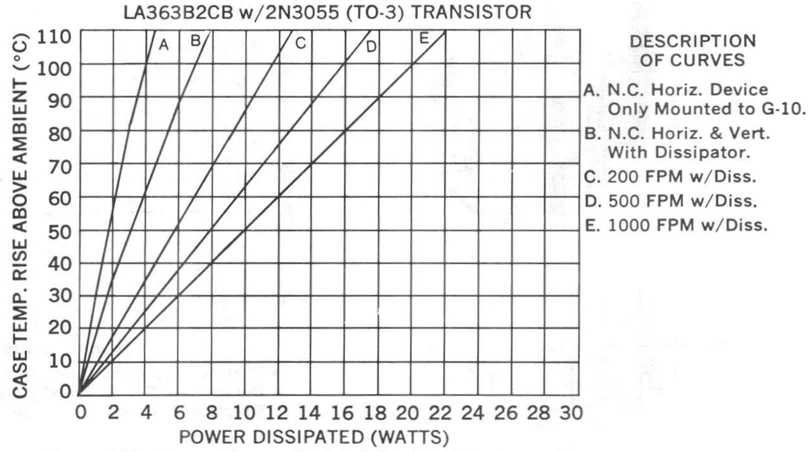
LA363B2





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LA363B2CB w/2N3055 (TO-3) TRANSISTOR



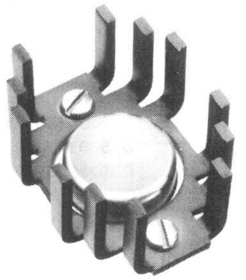
- Thermal Resistance Case to Sink is 1.0-1.4 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

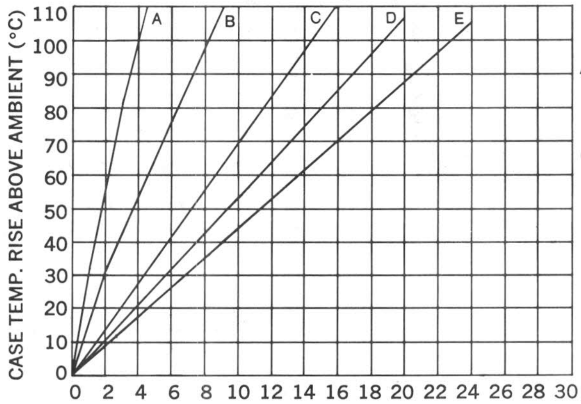
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA363B2U	LA363B2CB	LA363B2B	LA363B2	Any TO-3 can	3	6.0

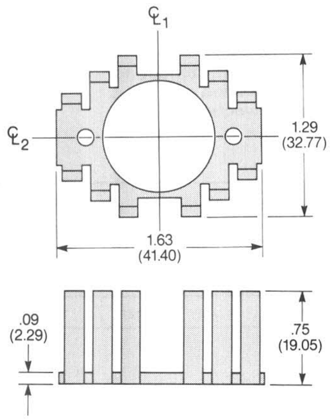
Note: See page iv for other finishes.

LA363B3





DESCRIPTION OF CURVES
- A. N.C. Horiz. Device Only Mounted to G-10.
- B. N.C. Horiz. & Vert. With Dissipator.
- C. 200 FPM w/Diss.
- D. 500 FPM w/Diss.
- E. 1000 FPM w/Diss.



- Thermal Resistance Case to Sink is 1.0-1.4 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

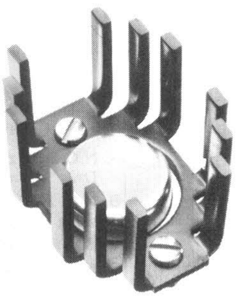
Ordering Information

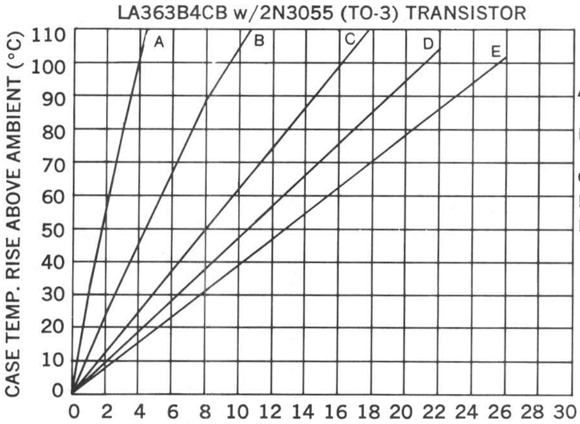
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA363B3U	LA363B3CB	LA363B3B	LA363B3	Any TO-3 can	3	8.2

Note: See page iv for other finishes.

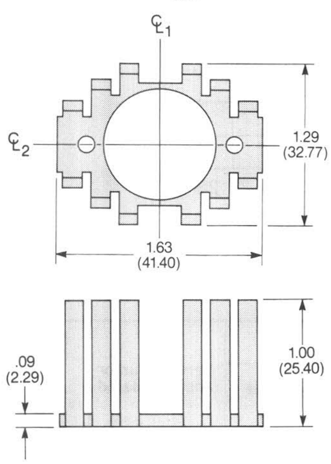
Dimensions are for reference use only. Contact IERC for dimehsions with tolerances or standard part drawings.

LA363B4





DESCRIPTION OF CURVES
- A. N.C. Horiz. Device Only Mounted to G-10.
- B. N.C. Horiz. & Vert. With Dissipator.
- C. 200 FPM w/Diss.
- D. 500 FPM w/Diss.
- E. 1000 FPM w/Diss.



- Thermal Resistance Case to Sink is 1.0-1.4 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

Ordering Information

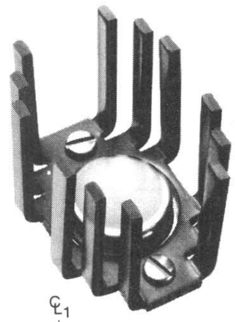
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA363B4U	LA363B4CB	LA363B4B	LA363B4	Any TO-3 can	3	10.4

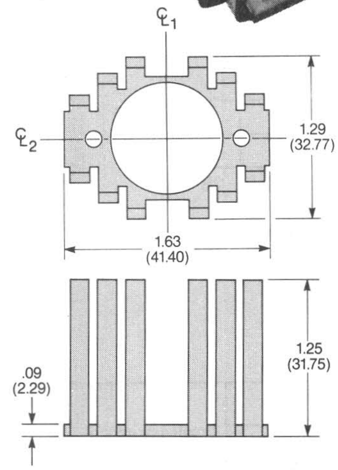
Note: See page iv for other finishes.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

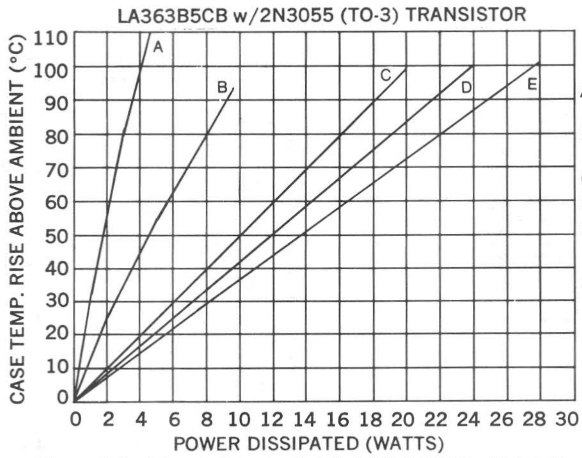
HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

LA363B5





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 1.0-1.4 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

Ordering Information

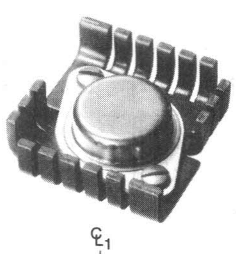
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA363B5U	LA363B5CB	LA363B5B	LA363B5	Any TO-3 can	3	12.6

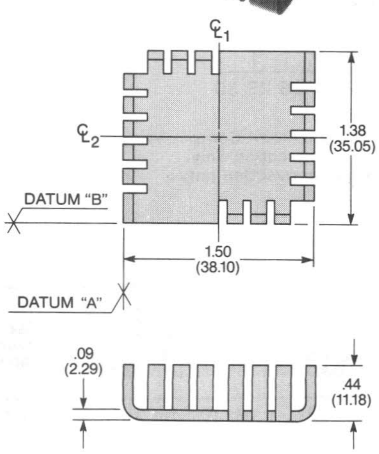
Note: See page iv for other finishes.

Medium-to-high power, board-mounted heat dissipators

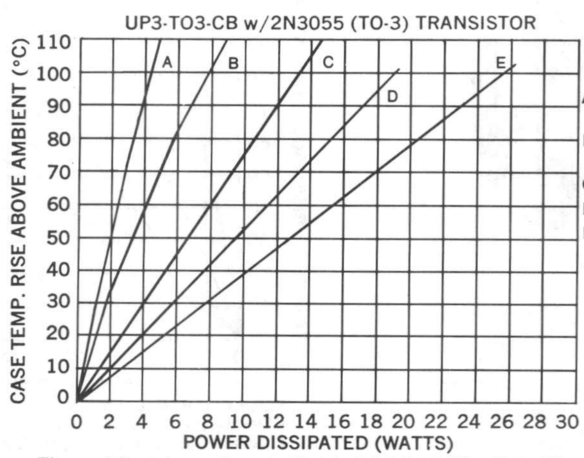
- Different heights for greater design flexibility.
- Performance superior to similar dissipators made from impact extrusions or die castings.
- Semiconductor mounting fasteners hold dissipator in position.
- Square shape of the dissipator allows dissipation to be effective regardless of air flow direction.

UP3 Series for TO-3 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

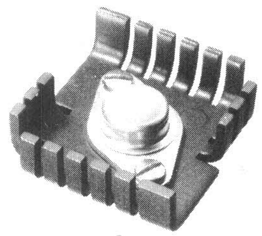
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

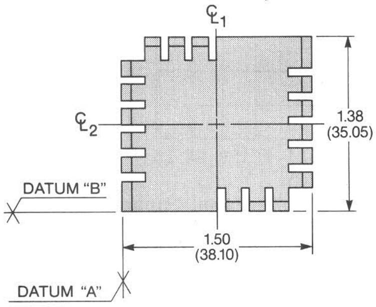
Ordering Information

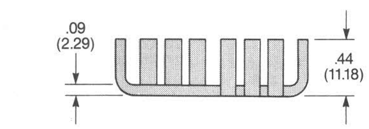
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP3-000-U	UP3-000-CB	UP3-000-B	UP3-000	Undrilled	—	10.5
UP3-T03-U	UP3-T03-CB	UP3-T03-B	UP3-T03	TO-3	11	10.5
UP3-425-U	UP3-425-CB	UP3-425-B	UP3-425	Universal	15	10.5

Note: See page iv for other finishes.

UP3 Series for TO-66 Outline

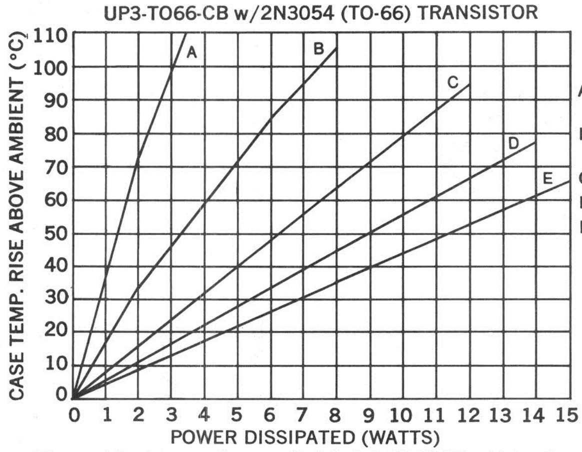






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP3-TO66-CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

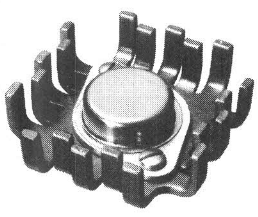
- Thermal Resistance Case to Sink is 0.6-0.7 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

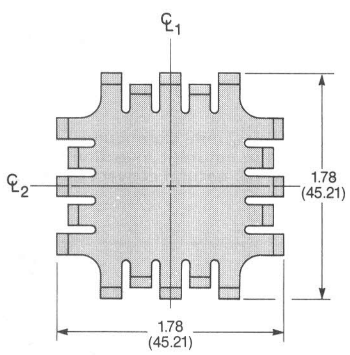
Ordering Information

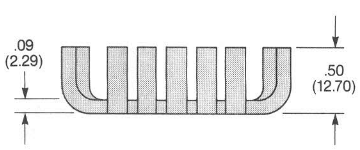
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP3-TO66-U	UP3-TO66-CB	UP3-TO66-B	UP3-TO66	TO-66	14	10.5

Note: See page iv for other finishes.

UP1 Series for TO-3 Outline and Stud Mount Devices

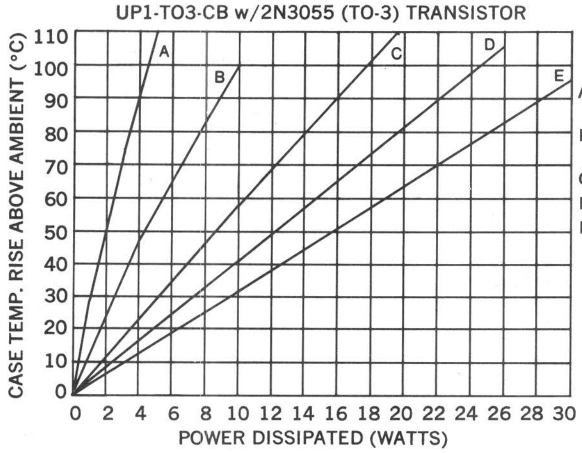






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP1-TO3-CB w/2N3055 (TO-3) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

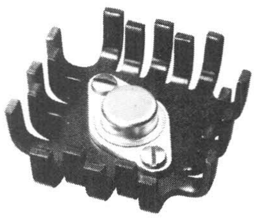
Ordering Information

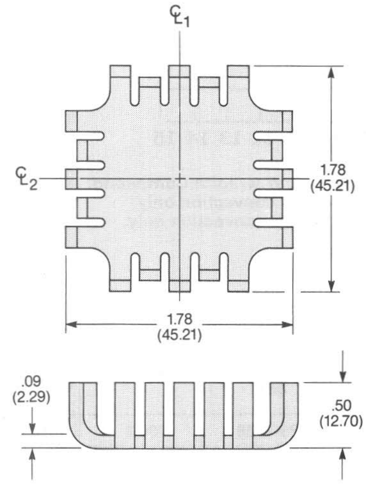
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP1-000-U	UP1-000-CB	UP1-000-B	UP1-000	Undrilled	—	15.5
UP1-TO3-U	UP1-TO3-CB	UP1-TO3-B	UP1-TO3	TO-3	16	15.5
UP1-TO3-46U	UP1-TO3-46CB	UP1-TO3-46B	UP1-TO3-46	TO-3 IC	17	15.5
UP1-436-U	UP1-436-CB	UP1-436-B	UP1-436	TO-3 (4-pin)	18	15.5
UP1-TO6-U	UP1-TO6-CB	UP1-TO6-B	UP1-TO6	TO-6, TO-36	19	15.5
UP1-TO15-U	UP1-TO15-CB	UP1-TO15-B	UP1-TO15	TO-15, DO-5	23	15.5
UP1-420-U	UP1-420-CB	UP1-420-B	UP1-420	Universal	27	15.5
UP1-TOV-7U	UP1-TOV-7CB	UP1-TOV-7B	UP1-TOV-7	Universal	28	15.5

Note: See page iv for other finishes.

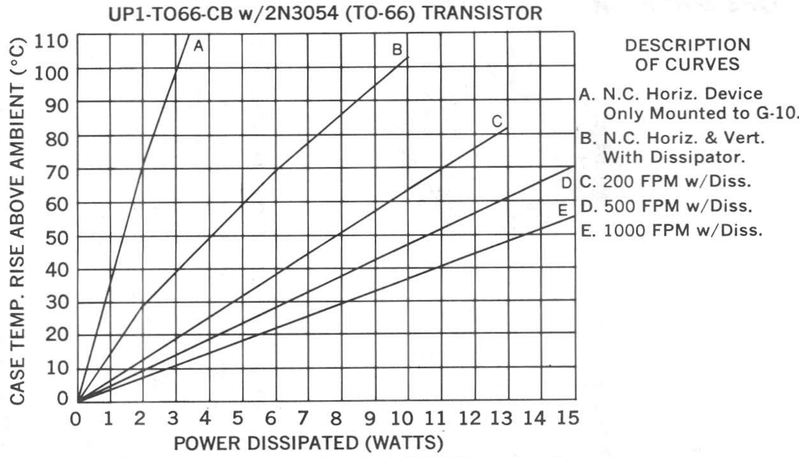
HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

UP1 Series for TO-66 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



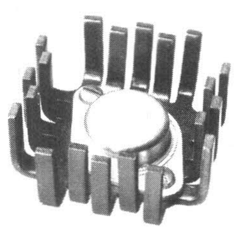
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

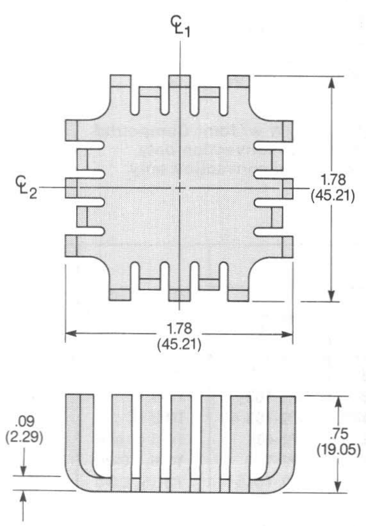
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-29)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP1-T066-U	UP1-T066-CB	UP1-T066-B	UP1-T066	TO-66	24	15.5
UP1-T066-47U	UP1-T066-47CB	UP1-T066-47B	UP1-T066-47	TO-66 IC	25	15.5
UP1-T066-52U	UP1-T066-52CB	UP1-T066-52B	UP1-T066-52	TO-66 IC (Socket)	26	15.5

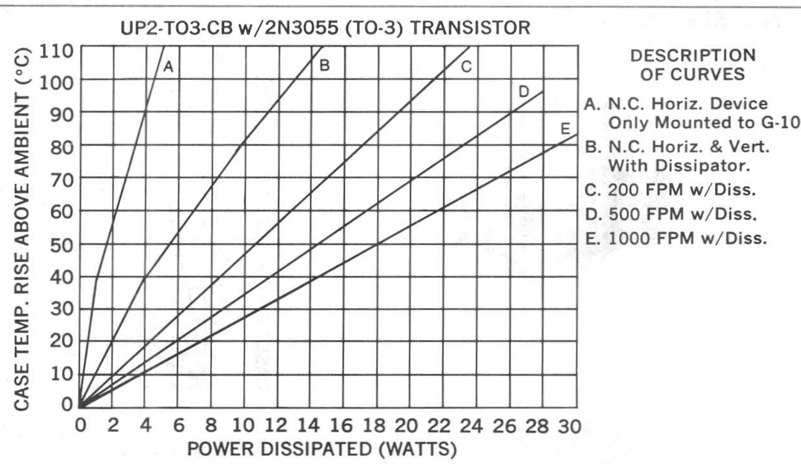
Note: See page iv for other finishes.

UP2 Series for TO-3 and Stud Mount Outlines





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



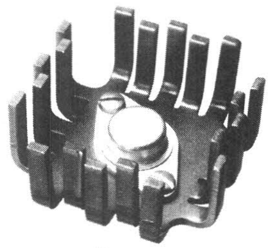
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.8 °C/watt per device for unplated part in natural convection only.
- Derate 0.4 °C/watt per device for Insulube® part in natural convection only.

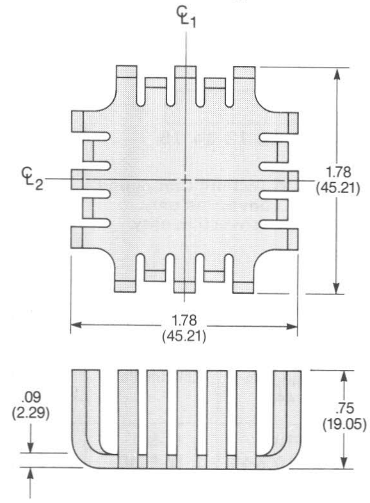
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP2-000-U	UP2-000-CB	UP2-000-B	UP2-000	Undrilled	—	19.1
UP2-T03-U	UP2-T03-CB	UP2-T03-B	UP2-T03	TO-3	16	19.1
UP2-T03-46U	UP2-T03-46CB	UP2-T03-46B	UP2-T03-46	TO-3 IC	17	19.1
UP2-436-U	UP2-436-CB	UP2-436-B	UP2-436	TO-3 (4-pin)	18	19.1
UP2-T06-U	UP2-T06-CB	UP2-T06-B	UP2-T06	TO-6, TO-36	19	19.1
UP2-T015-U	UP2-T015-CB	UP2-T015-B	UP2-T015	TO-15	23	19.1
UP2-420-U	UP2-420-CB	UP2-420-B	UP2-420	Universal	27	19.1
UP2-TOV-7U	UP2-TOV-7CB	UP2-TOV-7B	UP2-TOV-7	Universal	28	19.1

Note: See page iv for other finishes.

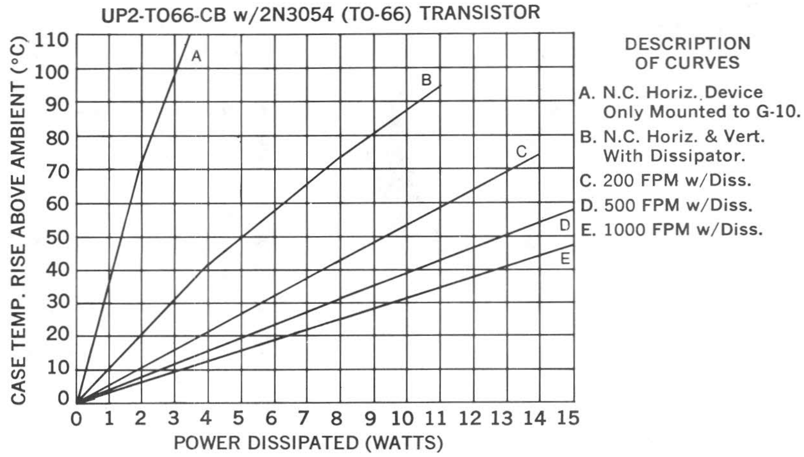
UP2 Series for TO-66 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP2-TO66-CB w/2N3054 (TO-66) TRANSISTOR



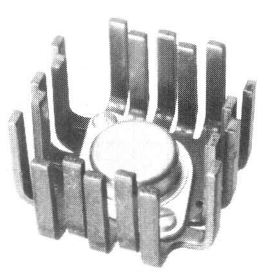
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

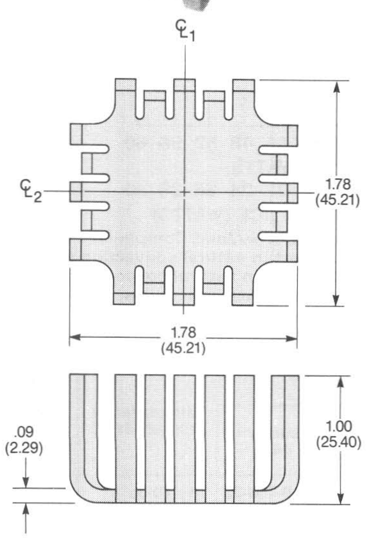
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-29)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP2-TO66-U	UP2-TO66-CB	UP2-TO66-B	UP2-TO66	TO-66	24	19.1
UP2-TO66-47U	UP2-TO66-47CB	UP2-TO66-47B	UP2-TO66-47	TO-66 IC	25	19.1
UP2-TO66-52U	UP2-TO66-52CB	UP2-TO66-52B	UP2-TO66-52	TO-66 IC (Socket)	26	19.1

Note: See page iv for other finishes.

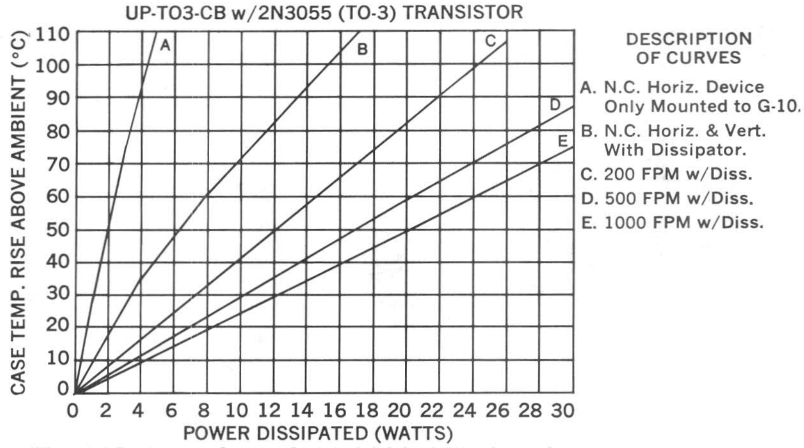
UP Series for TO-3 and Stud Mount Outlines





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP-TO3-CB w/2N3055 (TO-3) TRANSISTOR



- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

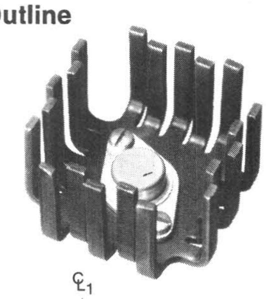
Ordering Information

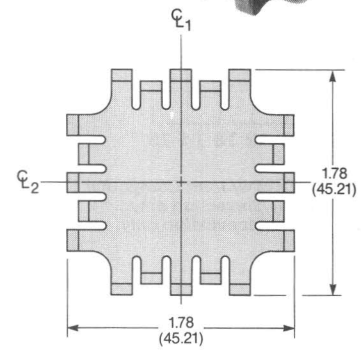
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP-000-U	UP-000-CB	UP-000-B	UP-000	Undrilled	—	22.5
UP-TO3-U	UP-TO3-CB	UP-TO3-B	UP-TO3	TO-3	16	22.5
UP-TO3-46U	UP-TO3-46CB	UP-TO3-46B	UP-TO3-46	TO-3 IC	17	22.5
UP-436-U	UP-436-CB	UP-436-B	UP-436	TO-3 (4-pin)	18	22.5
UP-TO6-U	UP-TO6-CB	UP-TO6-B	UP-TO6	TO-6, TO-36	19	22.5
UP-TO15-U	UP-TO15-CB	UP-TO15-B	UP-TO15	TO-15, DO-5	23	22.5
UP-420-U	UP-420-CB	UP-420-B	UP-420	Universal	27	22.5
UP-TOV-7U	UP-TOV-7CB	UP-TOV-7B	UP-TOV-7	Universal	28	22.5

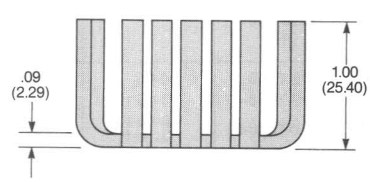
Note: See page iv for other finishes.

HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

UP Series for TO-66 Outline

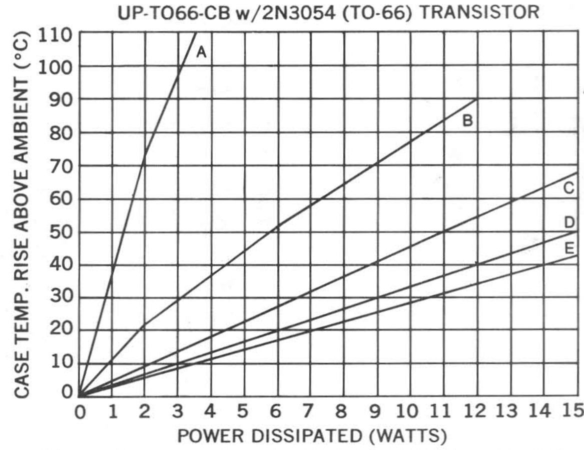






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP-TO66-CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

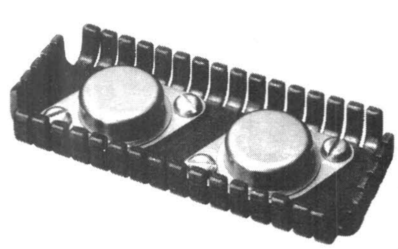
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

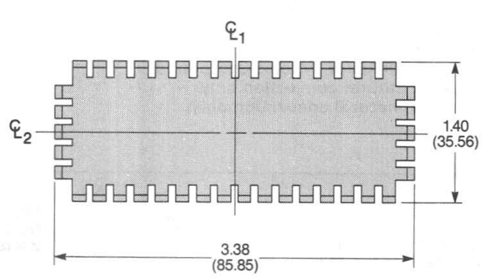
Ordering Information

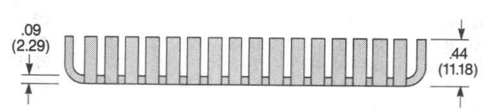
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-29)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP-T066-U	UP-T066-CB	UP-T066-B	UP-T066	T0-66	24	22.5
UP-T066-47U	UP-T066-47CB	UP-T066-47B	UP-T066-47	T0-66 IC	25	22.5
UP-T066-52U	UP-T066-52CB	UP-T066-52B	UP-T066-52	T0-66 IC (Socket)	26	22.5

Note: See page iv for other finishes.

UP10 Series for TO-3 Dual Mount Applications

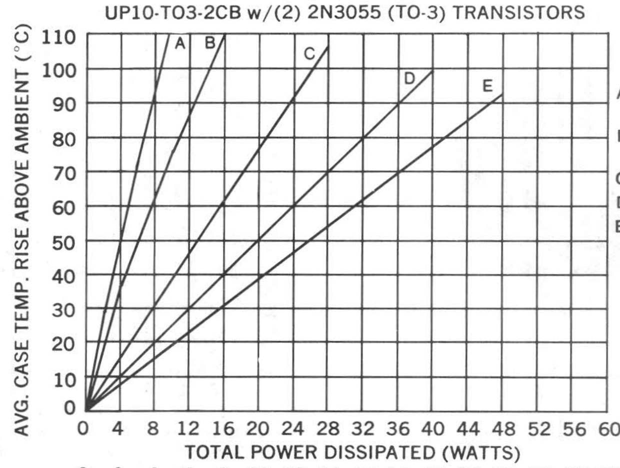






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP10-TO3-2CB w/(2) 2N3055 (TO-3) TRANSISTORS



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

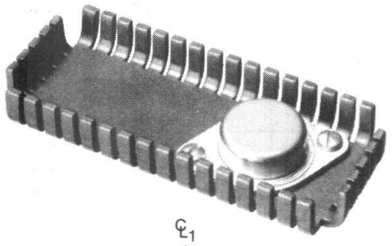
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.8 °C/watt per device for unplated part in natural convection only.
- Derate 0.4 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

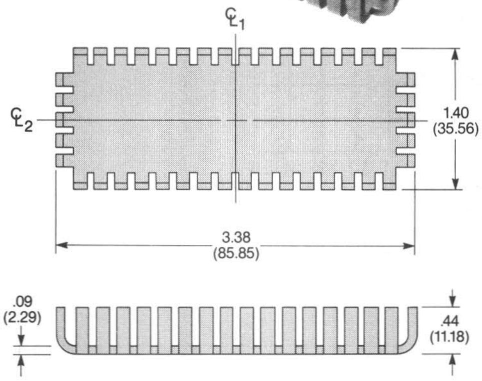
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-29)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP10-T03-2U	UP10-T03-2CB	UP10-T03-2B	UP10-T03-2	Two TO-3s	29	24.0
UP10-426-2U	UP10-426-2CB	UP10-426-2B	UP10-426-2	Universal	30	24.0
UP10-428-2U	UP10-428-2CB	UP10-428-2B	UP10-428-2	Two TO-3 (4-pin)	36	24.0

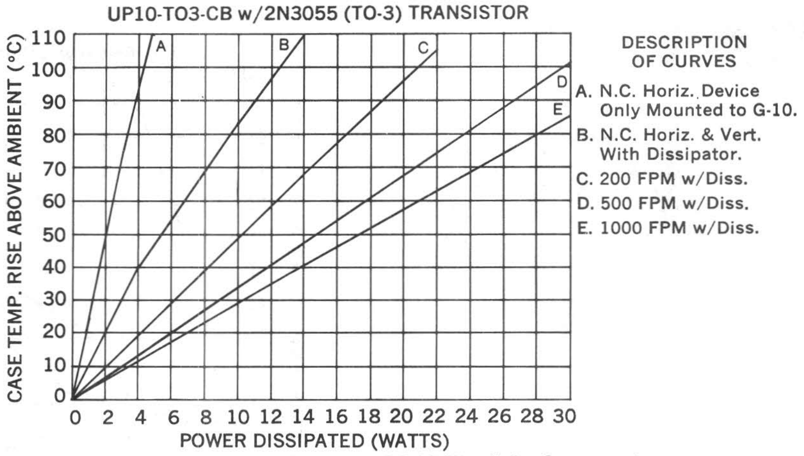
Note: See page iv for other finishes.

UP10 for Single TO-3 Outline





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 0.4 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

Ordering Information

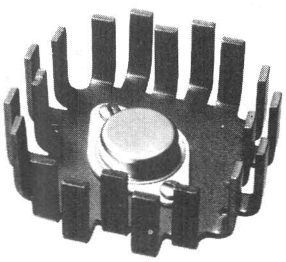
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-31)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP10-T03-U	UP10-T03-CB	UP10-T03-B	UP10-T03	TO-3	37	24.0

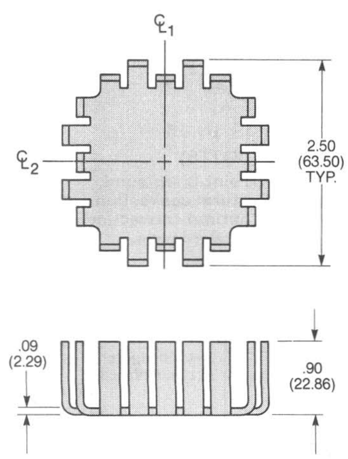
Note: See page iv for other finishes.

High-power heat dissipators

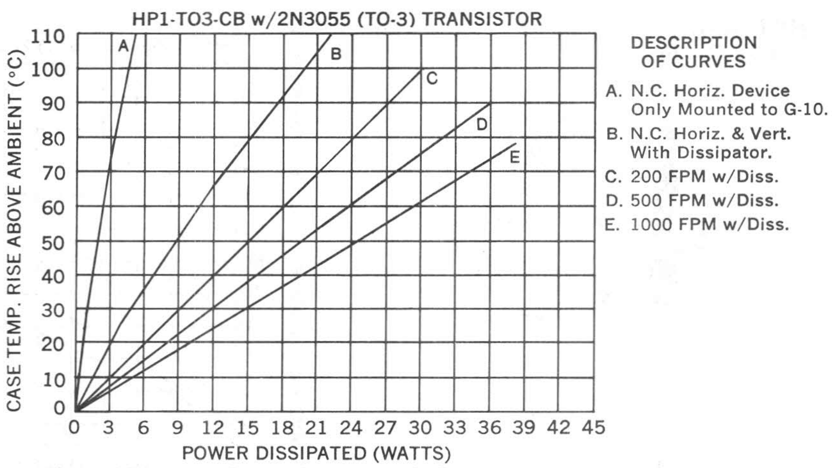
- Performance comparable to extrusions three times heavier and with 50% more volume.
- Uses less board space than more costly extrusions, and thereby increases design options as to where dissipators and hot semiconductors are located.
- An HP1 dissipator can be nested inside an HP3 dissipator to provide a substantial increase in dissipating surface without any increase in board space or volume requirement.

HP1 Series for Single TO-3 or Stud Mount Devices





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

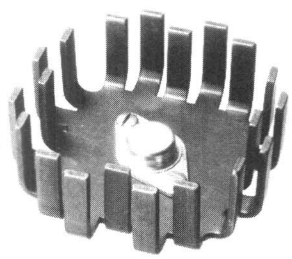
Ordering Information

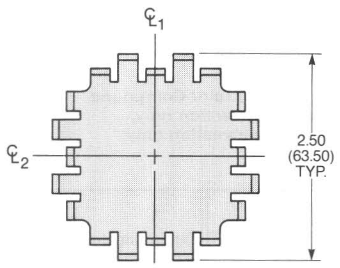
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP1-000-U	HP1-000-CB	HP1-000-B	HP1-000	Undrilled	—	35.0
HP1-T03-U	HP1-T03-CB	HP1-T03-B	HP1-T03	TO-3	16	35.0
HP1-T03-33U	HP1-T03-33CB	HP1-T03-33B	HP1-T03-33	TO-3 IC	17	35.0
HP1-T03-44U	HP1-T03-44CB	HP1-T03-44B	HP1-T03-44	TO-3 panel mount	31	35.0
HP1-436-U	HP1-436-CB	HP1-436-B	HP1-436	TO-3 (4-pin)	18	35.0
HP1-T06-U	HP1-T06-CB	HP1-T06-B	HP1-T06	TO-6, TO-36	19	35.0
HP1-T015-U	HP1-T015-CB	HP1-T015-B	HP1-T015	TO-15, DO-5	23	35.0
HP1-420-U	HP1-420-CB	HP1-420-B	HP1-420	Universal	27	35.0

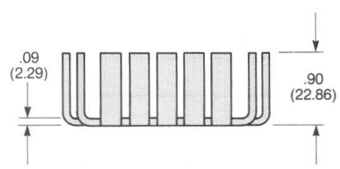
Note: See page iv for other finishes.

HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

HP1 Series for Single TO-66 Outline

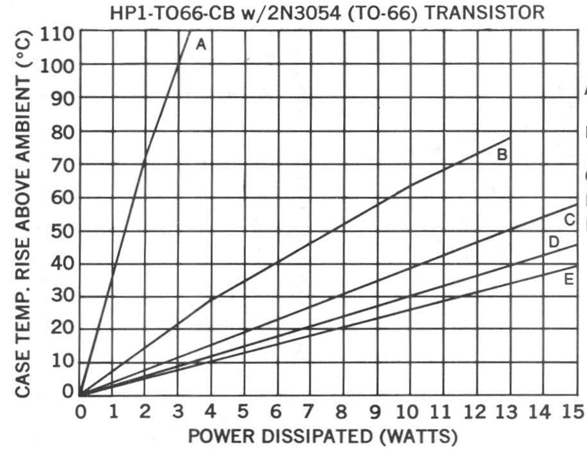






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HP1-TO66-CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

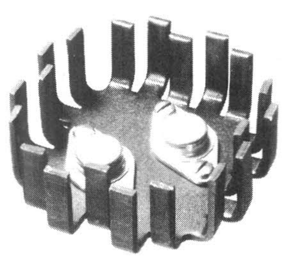
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

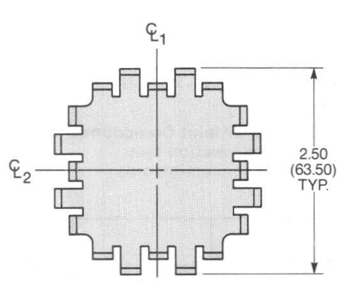
Ordering Information

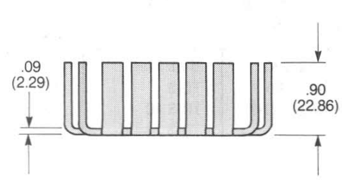
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-29)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP1-TO66-U	HP1-TO66-CB	HP1-TO66-B	HP1-TO66	TO-66	24	35.0
HP1-TO66-35U	HP1-TO66-35CB	HP1-TO66-35B	HP1-TO66-35	TO-66 IC	25	35.0
HP1-TO66-49U	HP1-TO66-49CB	HP1-TO66-49B	HP1-TO66-49	TO-66 IC (Socket)	26	35.0

Note: See page iv for other finishes.

HP1 Series for Dual TO-66 Outline

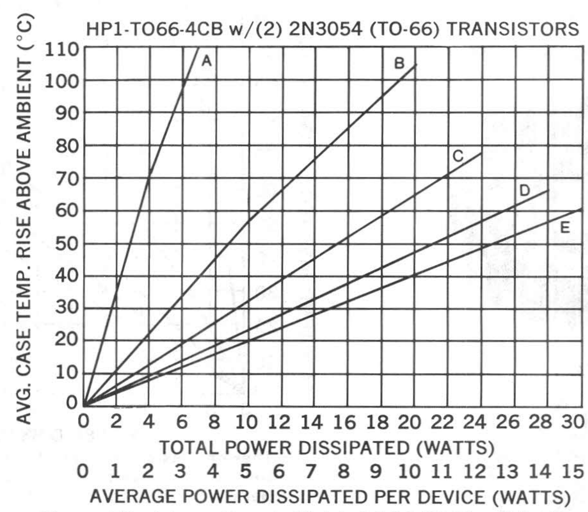






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HP1-TO66-4CB w/(2) 2N3054 (TO-66) TRANSISTORS



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

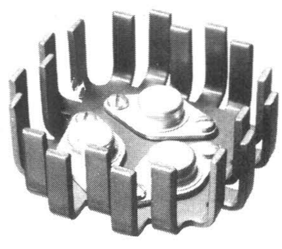
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 2.0 °C/watt per device for unplated part in natural convection only.
- Derate 0.8 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

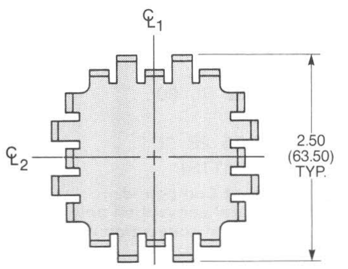
Ordering Information

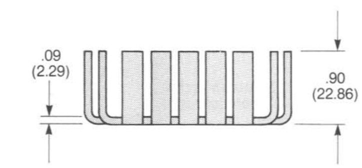
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-30)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP1-TO66-4U	HP1-TO66-4CB	HP1-TO66-4B	HP1-TO66-4	Two TO-66s	32	35.0
HP1-TO66-36U	HP1-TO66-36CB	HP1-TO66-36B	HP1-TO66-36	Two TO-66 ICs	34	35.0

Note: See page iv for other finishes.

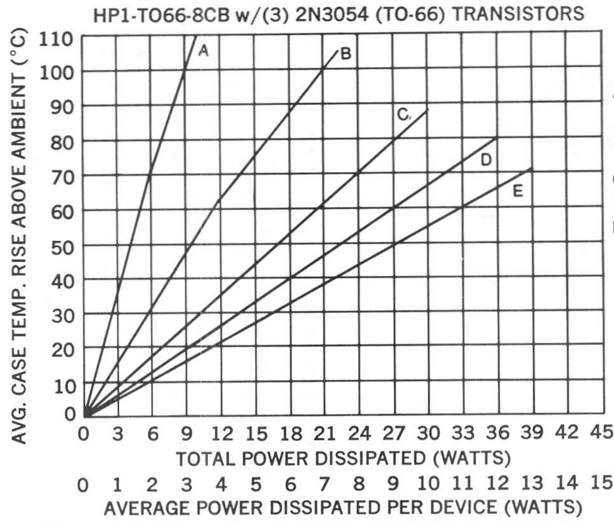
HP1 Series for Three TO-66 Outline







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

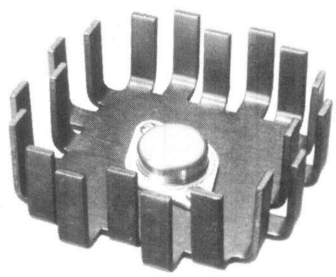
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 3.0 °C/watt per device for unplated part in natural convection only.
- Derate 0.8 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels in natural convection.

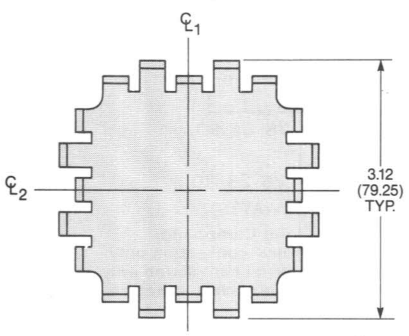
Ordering Information

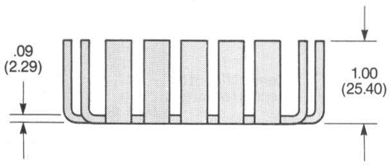
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-30)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP1-TO66-8U	HP1-TO66-8CB	HP1-TO66-8B	HP1-TO66-8	Three TO-66s	33	35.0
HP1-TO66-39U	HP1-TO66-39CB	HP1-TO66-39B	HP1-TO66-39	Three TO-66 ICs	35	35.0

Note: See page iv for other finishes.

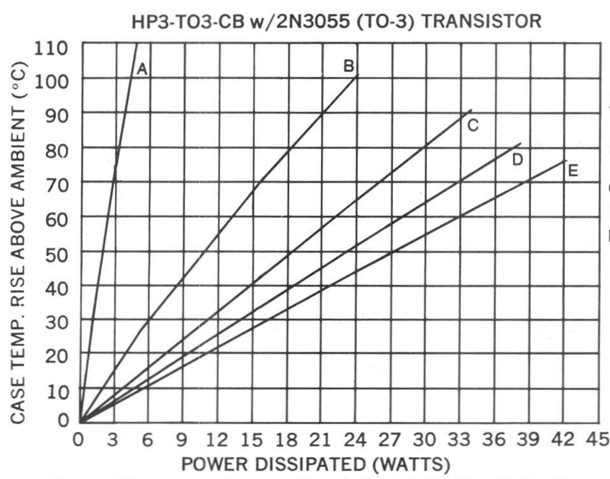
HP3 Series for Single TO-3 or Stud Mount







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 0.4 °C/watt for Insulube® part in natural convection only.

Ordering Information

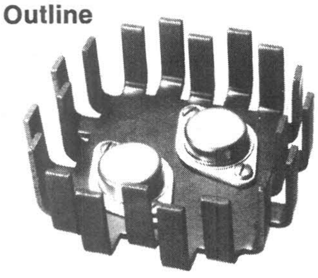
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-000-U	HP3-000-CB	HP3-000-B	HP3-000	Undrilled	—	55.0
HP3-TO3-U	HP3-TO3-CB	HP3-TO3-B	HP3-TO3	TO-3	16	55.0
HP3-TO3-33U	HP3-TO3-33CB	HP3-TO3-33B	HP3-TO3-33	TO-3 IC	17	55.0
HP3-TO3-44U	HP3-TO3-44CB	HP3-TO3-44B	HP3-TO3-44	TO-3 panel mount	31	55.0
HP3-436-U	HP3-436-CB	HP3-436-B	HP3-436	TO-3 (4-pin)	18	55.0
HP3-TO15-U	HP3-TO15-CB	HP3-TO15-B	HP3-TO15	TO-15, DO-5	23	55.0
HP3-TO6-U	HP3-TO6-CB	HP3-TO6-B	HP3-TO6	TO-6, TO-36	19	55.0
HP3-420-U	HP3-420-CB	HP3-420-B	HP3-420	Universal	27	55.0

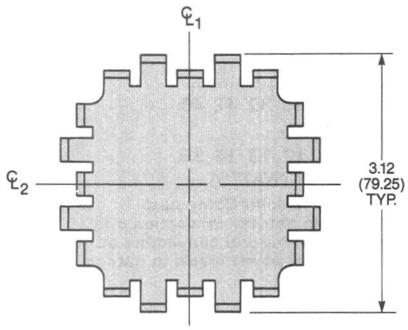
Note: See page iv for other finishes.

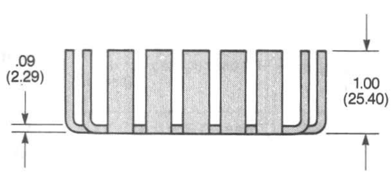
SECTION 1

HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

HP3 for Dual TO-3 Outline

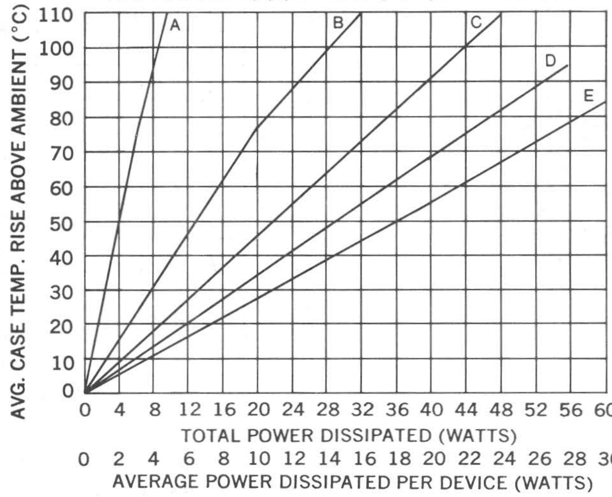






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HP3-TO3-4CB w/(2) 2N3055 (TO-3) TRANSISTORS



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

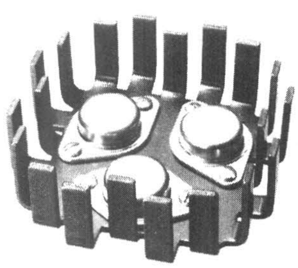
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 2.0 °C/watt per device for unplated part in natural convection only.
- Derate 0.4 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2.5°C at equivalent power levels.

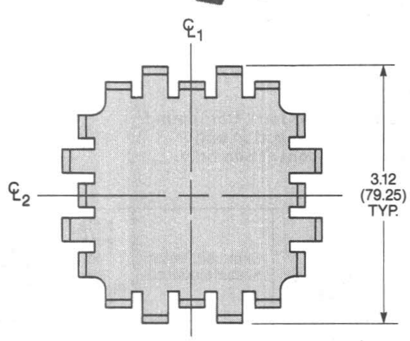
Ordering Information

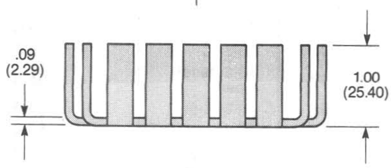
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-26)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-TO3-4U	HP3-TO3-4CB	HP3-TO3-4B	HP3-TO3-4	Two TO-3s	6	55.0
HP3-437-U	HP3-437-CB	HP3-437-B	HP3-437	Two TO-3s (4-pin)	12	55.0

Note: See page iv for other finishes.

HP3 for Three TO-3 Outline

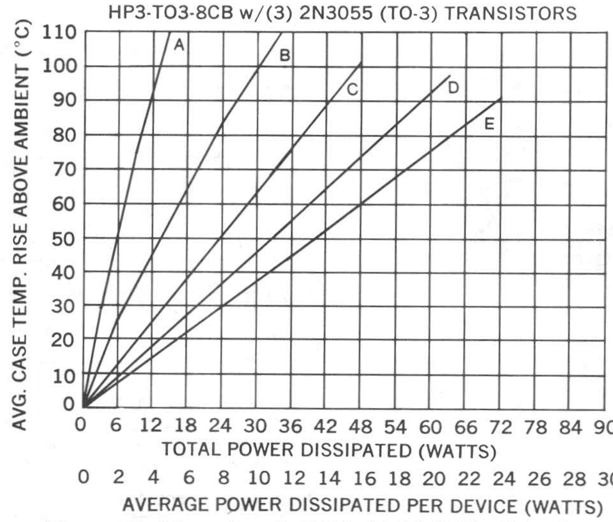






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HP3-TO3-8CB w/(3) 2N3055 (TO-3) TRANSISTORS



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

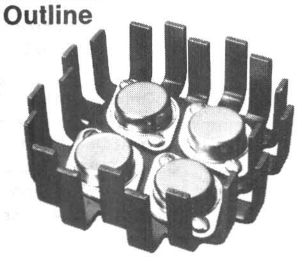
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 3.0 °C/watt per device for unplated part in natural convection only.
- Derate 0.4 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels in natural convection.

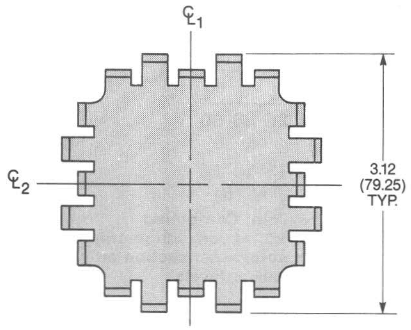
Ordering Information

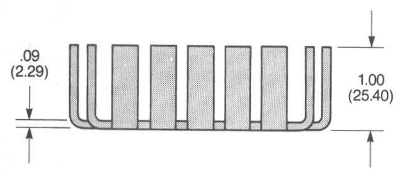
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-TO3-8U	HP3-TO3-8CB	HP3-TO3-8B	HP3-TO3-8	Three TO-3s	13	55.0

Note: See page iv for other finishes.

HP3 for Quad TO-3 Outline

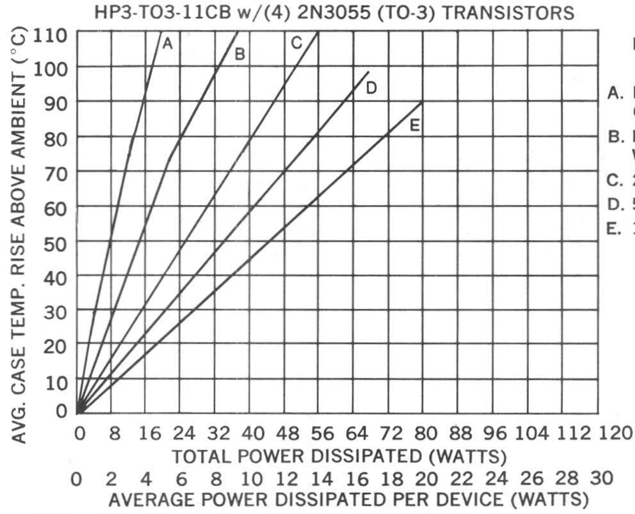






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HP3-TO3-11CB w/(4) 2N3055 (TO-3) TRANSISTORS



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

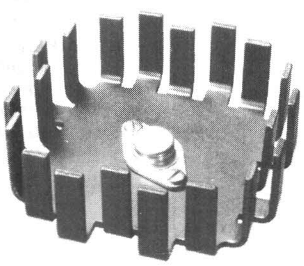
- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 4.0 °C/watt per device for unplated part in natural convection only.
- Derate 0.4 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 3°C at equivalent power levels in natural convection.

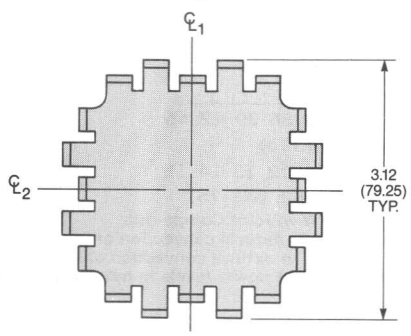
Ordering Information

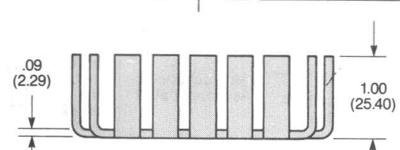
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-TO3-11U	HP3-TO3-11CB	HP3-TO3-11B	HP3-TO3-11	Four TO-3s	20	55.0
HP3-TO3-65U	HP3-TO3-65CB	HP3-TO3-65B	HP3-TO3-65	Four TO-3 ICs	38	55.0

Note: See page iv for other finishes.

HP3 for Single TO-66 Outline

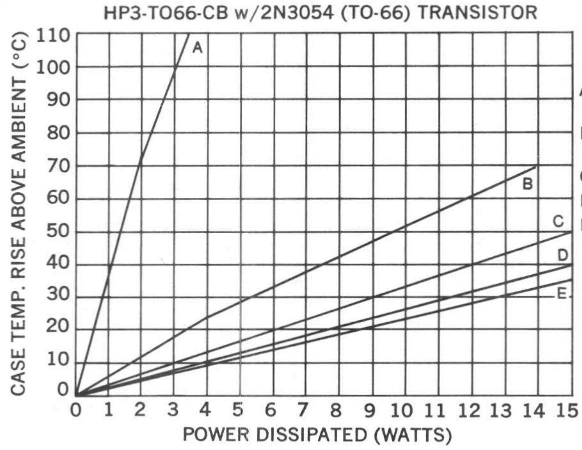






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HP3-TO66-CB w/2N3054 (TO-66) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 0.8 °C/watt for Insulube® part in natural convection only.

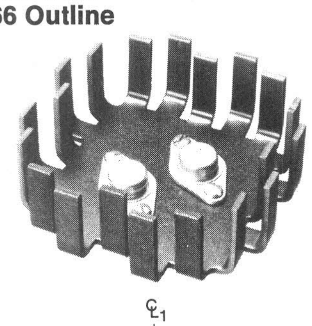
Ordering Information

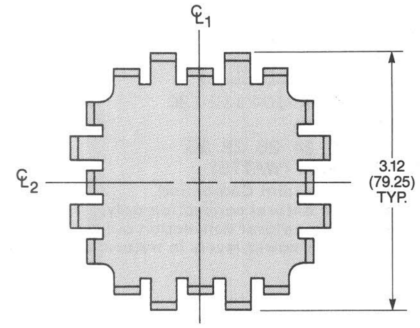
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-29)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-TO66-U	HP3-TO66-CB	HP3-TO66-B	HP3-TO66	TO-66	24	55.0
HP3-TO66-35U	HP3-TO66-35CB	HP3-TO66-35B	HP3-TO66-35	TO-66 IC	25	55.0
HP3-TO66-49U	HP3-TO66-49CB	HP3-TO66-49B	HP3-TO66-49	TO-66 IC (Socket)	26	55.0

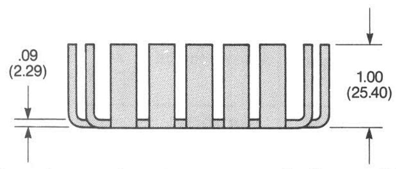
Note: See page iv for other finishes.

HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

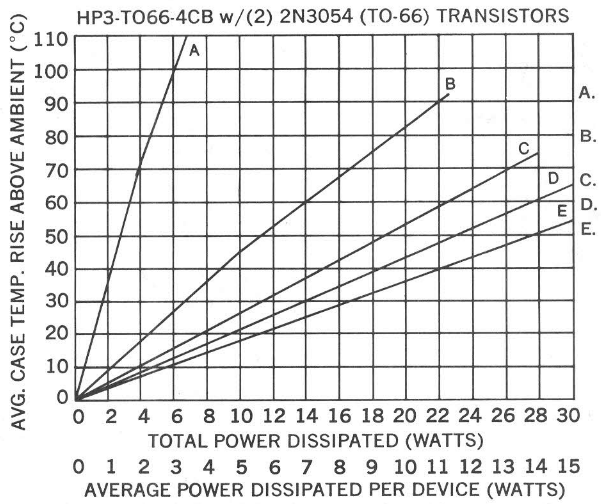
HP3 for Dual TO-66 Outline







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

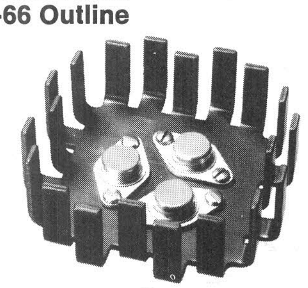
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 2.0 °C/watt per device for unplated part in natural convection only.
- Derate 0.8 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

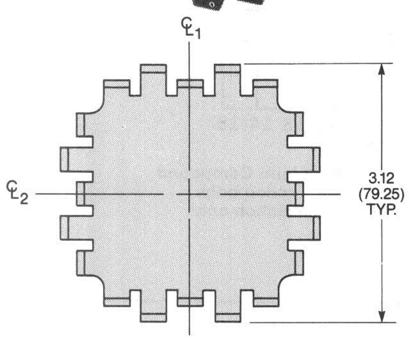
Ordering Information

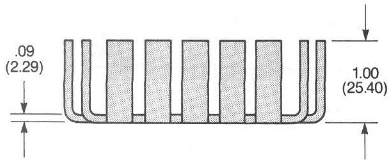
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-30)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-TO66-4U	HP3-TO66-4CB	HP3-TO66-4B	HP3-TO66-4	Two TO-66s	32	55.0
HP3-TO66-36U	HP3-TO66-36CB	HP3-TO66-36B	HP3-TO66-36	Two TO-66 ICs	34	55.0

Note: See page iv for other finishes.

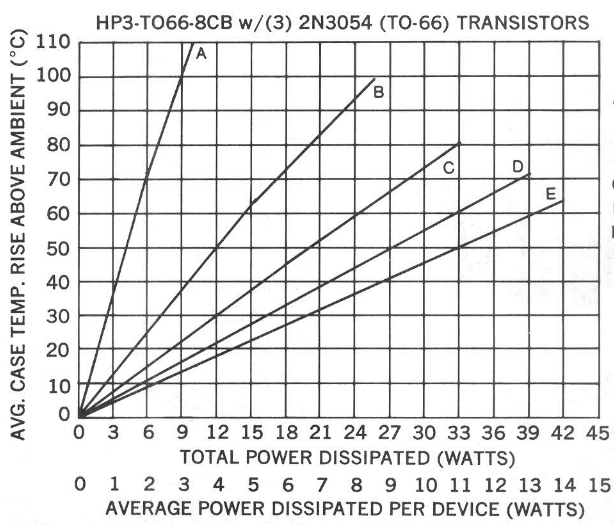
HP3 for Three TO-66 Outline







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

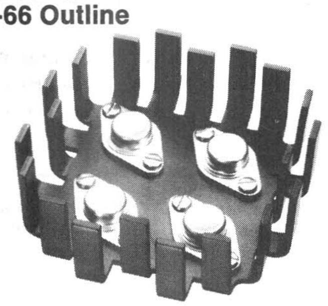
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 3.0 °C/watt per device for unplated part in natural convection only.
- Derate 0.8 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels in natural convection.

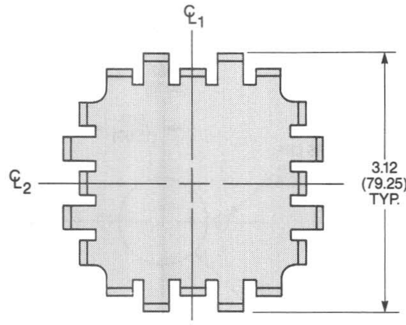
Ordering Information

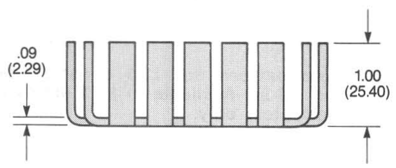
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-30)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-TO66-8U	HP3-TO66-8CB	HP3-TO66-8B	HP3-TO66-8	Three TO-66s	33	55.0
HP3-TO66-39U	HP3-TO66-39CB	HP3-TO66-39B	HP3-TO66-39	Three TO-66 ICs	35	55.0

Note: See page iv for other finishes.

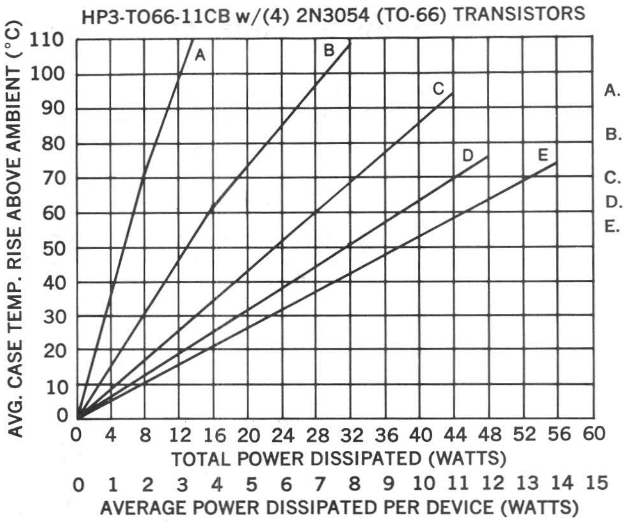
HP3 for Quad TO-66 Outline







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

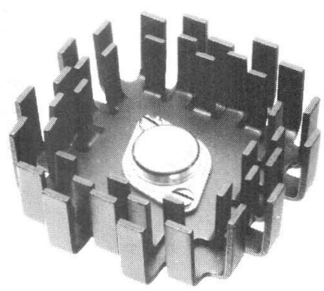
- Thermal Resistance Case to Sink is 0.5-0.7 °C/W w/Joint Compound.
- Derate 4.0 °C/watt per device for Insulube® part in natural convection only.
- Derate 0.8 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels in natural convection.

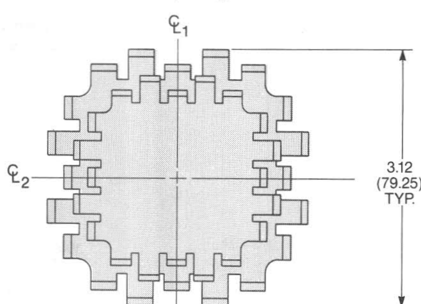
Ordering Information

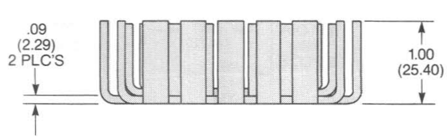
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-TO66-11U	HP3-TO66-11CB	HP3-TO66-11B	HP3-TO66-11	Four TO-66s	21	55.0
HP3-TO66-40U	HP3-TO66-40CB	HP3-TO66-40B	HP3-TO66-40	Four TO-66 ICs	22	55.0

Note: See page iv for other finishes.

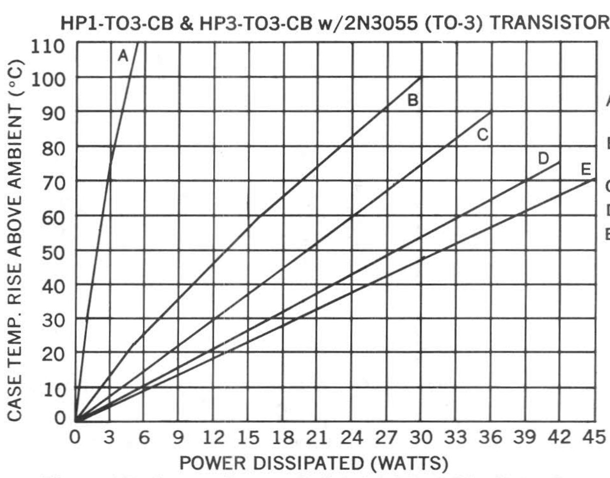
HP3/HP1 Nested for Single TO-3 or Stud Mount







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.1-0.3 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 0.5 °C/watt for Insulube® part in natural convection only.

Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 1-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP1-TO3-U HP3-TO3-U	HP1-TO3-CB HP3-TO3-CB	HP1-TO3-B HP3-TO3-B	HP1-TO3 HP3-TO3	TO-3	16	35.0 55.0
HP1-TO15-U HP3-TO15-U	HP1-TO15-CB HP3-TO15-CB	HP1-TO15-B HP3-TO15-B	HP1-TO15 HP3-TO15	TO-15, DO-5	23	35.0 55.0
HP1-TO6-U HP3-TO6-U	HP1-TO6-CB HP3-TO6-CB	HP1-TO6-B HP3-TO6-B	HP1-TO6 HP3-TO6	TO-6, TO-36	19	35.0 55.0

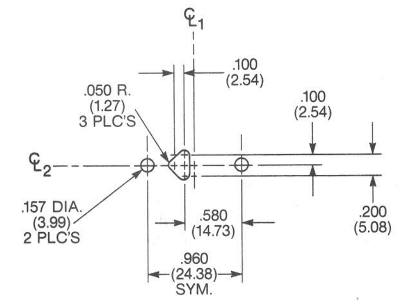
Note: See page iv for other finishes.
Note: Parts must be ordered separately.

HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

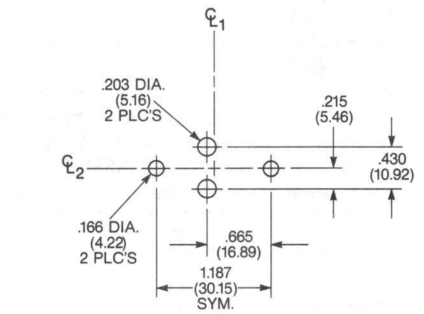
Standard hole patterns for metal case, case-mounted heat dissipators

- Hole patterns shown here will accommodate virtually any metal case, case-mounted semiconductor.
- Hole patterns 8, 15, 27, 28, and 30 are universal mounting hole patterns which simplify stocking and accommodate all metal case, case-mounted semiconductors.
- Tooling is available for many hole patterns not shown here. Consult IERC if you do not see a hole pattern to meet your requirements.

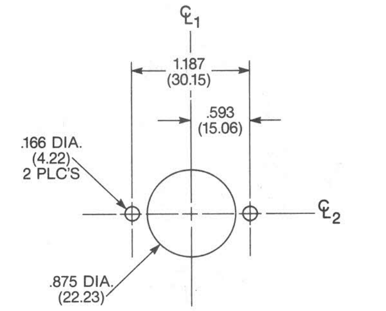
1. Hole pattern no. 248 accommodates TO-66s. Available in LA-A, LA-B, and LB series heat dissipators only.



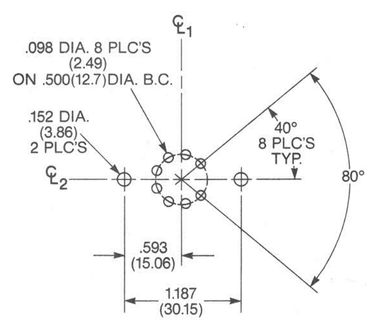
2. Hole pattern no. 236 accommodates TO-3s. Available in LA-B series heat dissipators only.



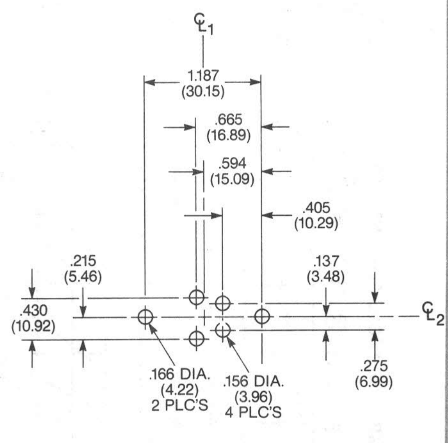
3. Hole pattern no. 363 accommodates TO-3s or TO-3 ICs. Available in LA-B series heat dissipators only.



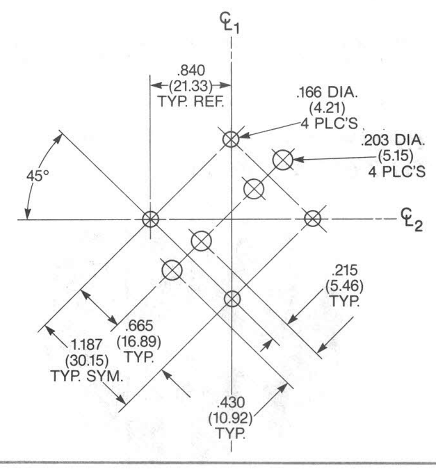
4. Hole pattern no. 237 accommodates TO-3 ICs. Available in LA-B series heat dissipators only.



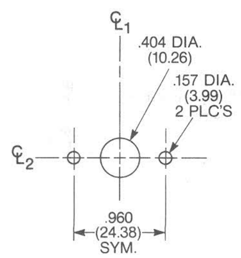
5. Hole pattern no. 407 accommodates TO-3s (4-pin). Available in LA-B series heat dissipators only.



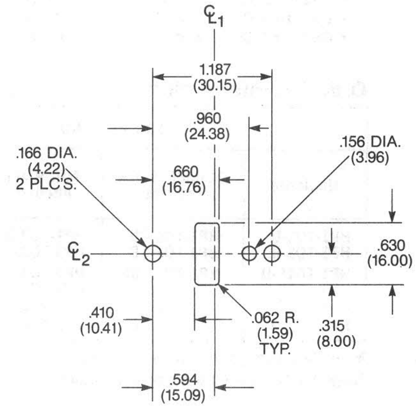
6. Hole pattern no. 124 accommodates two TO-3s. Available in HP3 series heat dissipators only.



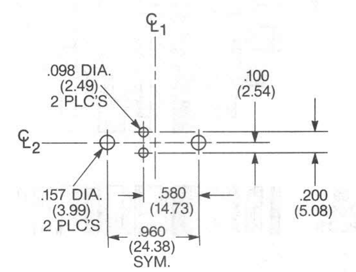
7. Hole pattern no. 191 accommodates TO-66 ICs. Available in LA-A, LA-B, and LB series heat dissipators only.



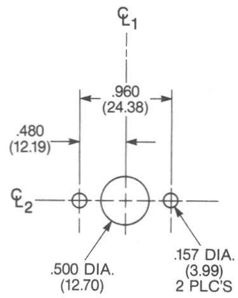
8. Hole pattern no. 394 (Universal) accommodates TO-3s, TO-66s, TO-126s, TO-127s, or TO-220s. Available in LA-B series heat dissipators only.



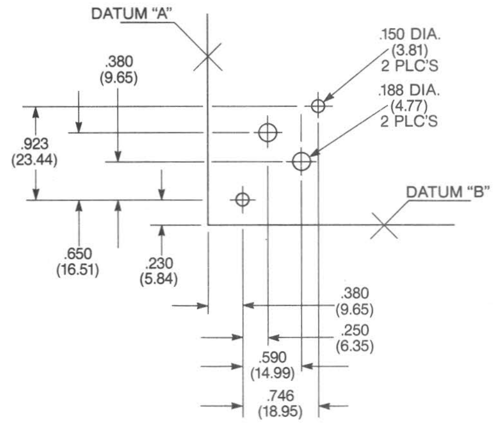
9. Hole pattern no. 133 accommodates TO-66s. Available in LB series heat dissipators only.



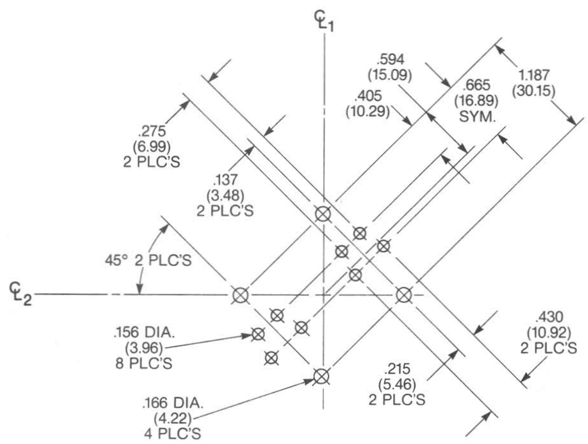
10. Hole pattern no. 225 accommodates TO-66 ICs (socket). Available in LB series heat dissipators only.



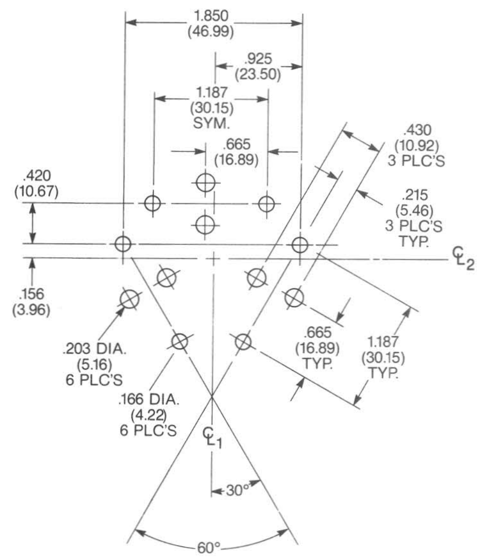
11. Hole pattern no. 15 accommodates TO-3s. Available in UP3 series heat dissipators only.



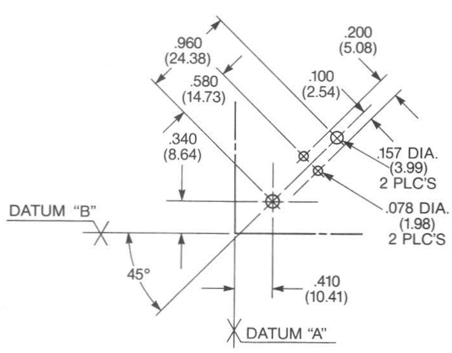
12. Hole pattern no. 437 accommodates two TO-3s (4-pin). Available in HP3 series heat dissipators only.



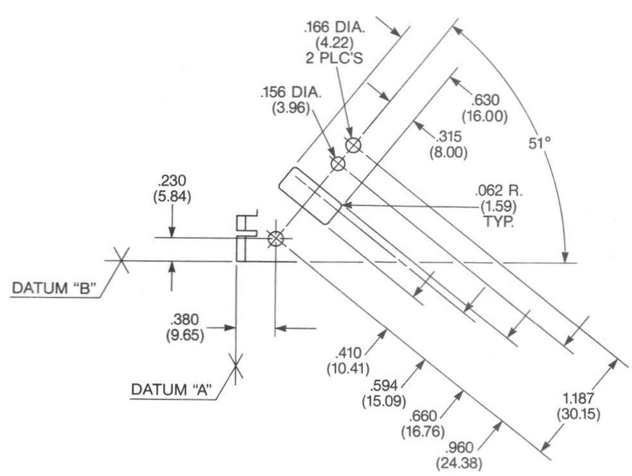
13. Hole pattern no. 186 accommodates three TO-3s. Available in HP3 series heat dissipators only.



14. Hole pattern no. 138 accommodates TO-66s. Available in UP3 series heat dissipators only.

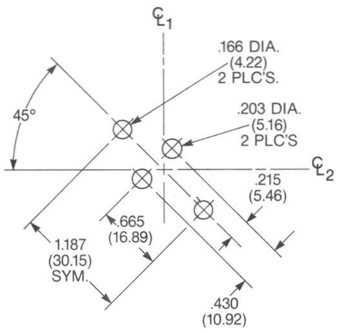


15. Hole pattern no. 425 (Universal) accommodates TO-3s or TO-66s. Available in UP3 series heat dissipators only.

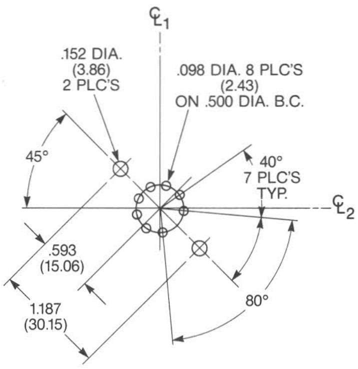


HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

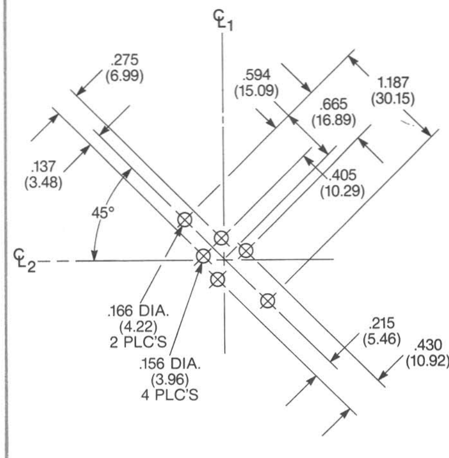
16. Hole pattern no. 1 accommodates TO-3s. Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators



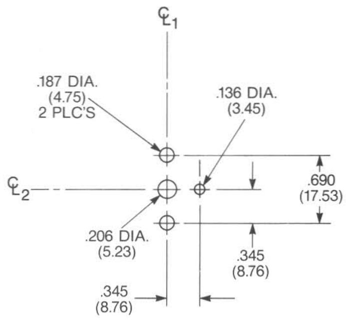
17. Hole pattern no. 202 accommodates TO-3 ICs. Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.



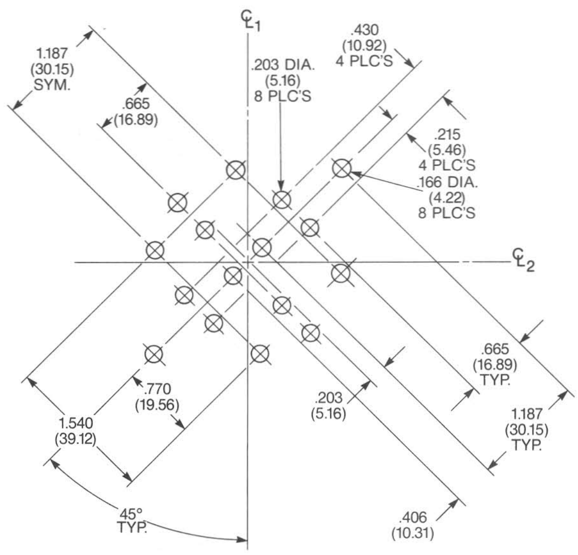
18. Hole pattern no. 436 accommodates TO-3s (4-pin). Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.



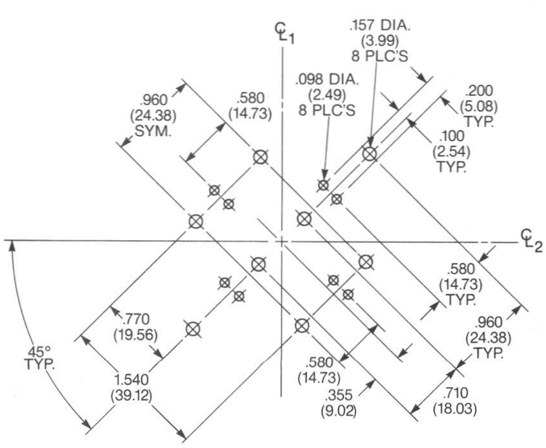
19. Hole pattern no. 2 accommodates TO-6s or TO-36s. Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.



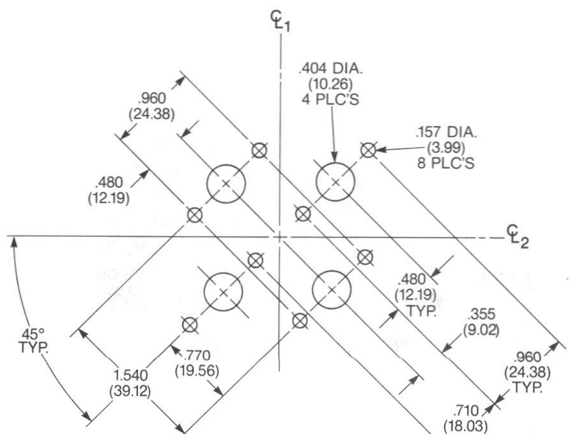
20. Hole pattern no. 187 accommodates four TO-3s. Available in HP3 series heat dissipators only.



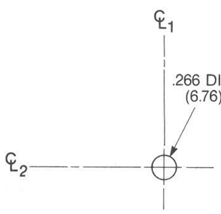
21. Hole pattern no. 188 accommodates four TO-66s. Available in HP3 series heat dissipators only.



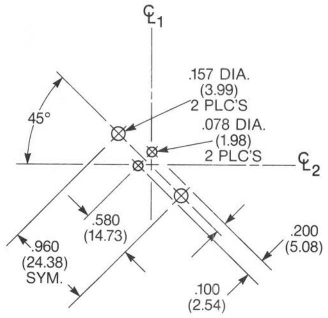
22. Hole pattern no. 204 accommodates four TO-66 ICs. Available in HP3 series heat dissipators only.



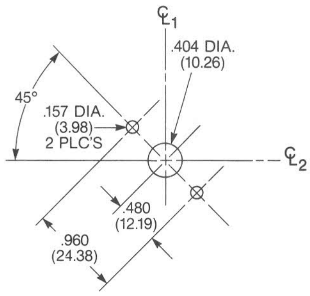
23. Hole pattern no. 3 accommodates TO-15s, DO-5s and other ¼″ stud mount devices. Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.



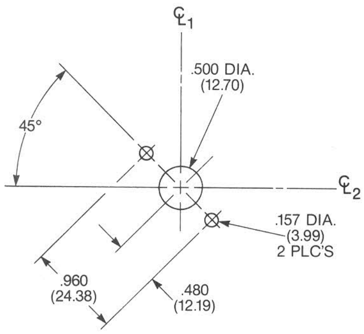
24. Hole pattern no. 114 accommodates TO-66s. Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.



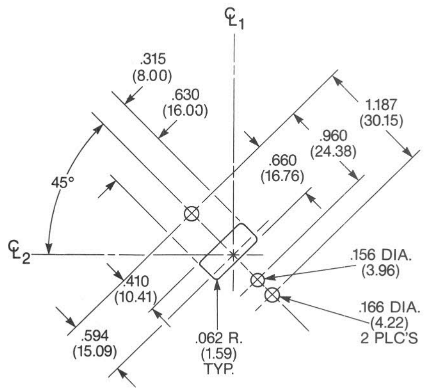
25. Hole pattern no. 199 accommodates TO-66 ICs. Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.



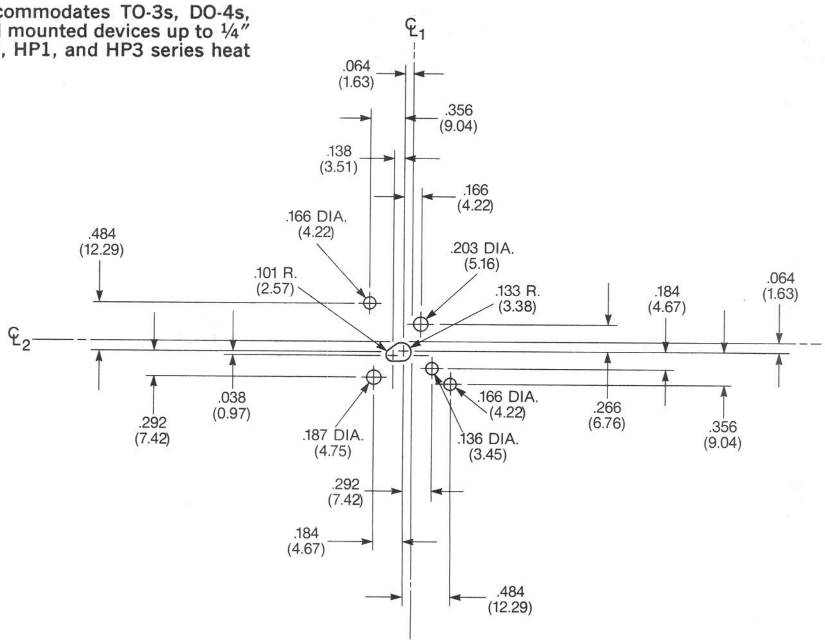
26. Hole pattern no. 226 accommodates TO-66 ICs (socket). Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.



27. Hole pattern no. 420 (Universal) accommodates TO-3s, TO-66s, TO-126s, TO-127s, or TO-220s. Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.

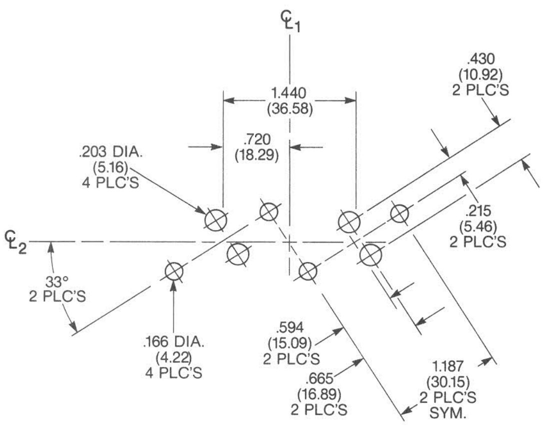


28. Hole pattern no. 64 (Universal) accommodates TO-3s, DO-4s, TO-15s, TO-6s, TO-36s, or other stud mounted devices up to ¼″ diameter. Available in UP, UP1, UP2, HP1, and HP3 series heat dissipators.

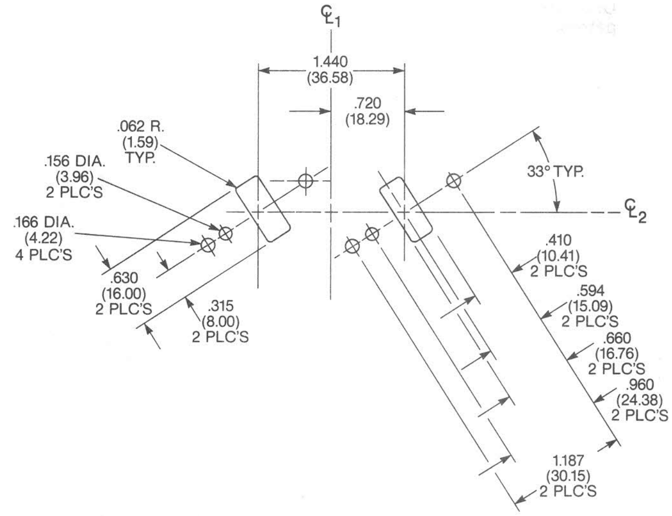


HEAT DISSIPATORS FOR METAL CASE, CASE-MOUNTED SEMICONDUCTORS

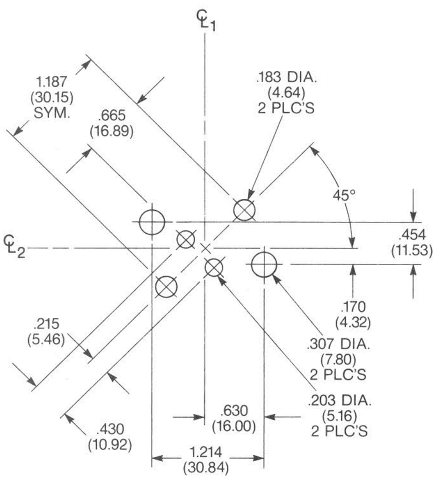
29. Hole pattern no. 222 accommodates TO-3s. Available in UP10 series heat dissipators only.



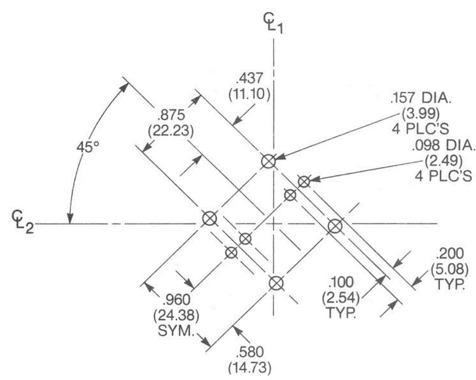
30. Hole pattern no. 426 (Universal) accommodates two TO-3s, TO-66s, TO-126s, TO-127s, or TO-220s. Available in UP10 series heat dissipators only.



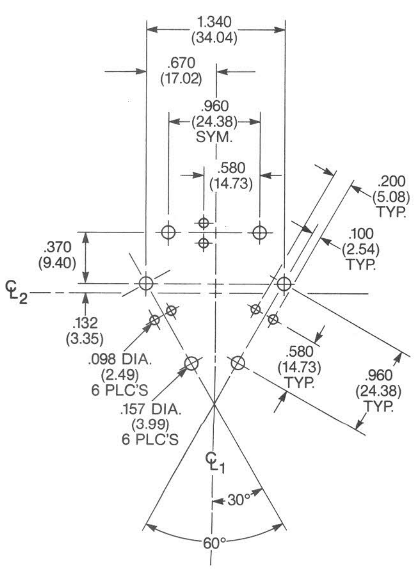
31. Hole pattern no. 213 accommodates one TO-3 (panel mounted). Available in HP1 and HP3 series heat dissipators only.



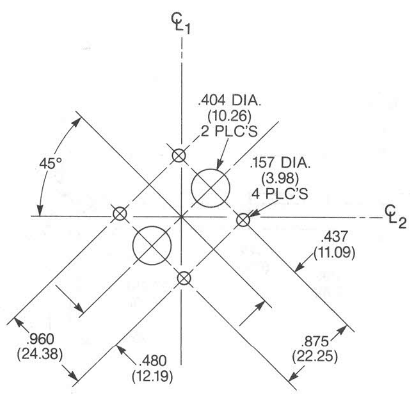
32. Hole pattern no. 150 accommodates two TO-66s. Available in HP1 and HP3 series heat dissipators only.



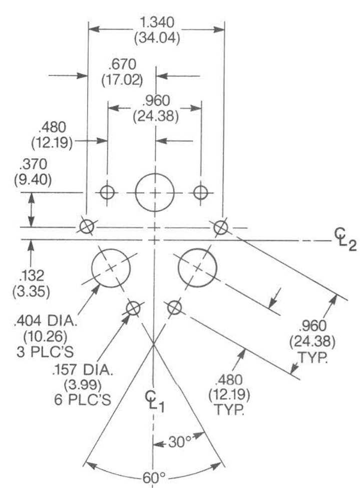
33. Hole pattern no. 185 accommodates three TO-66s. Available in HP1 and HP3 series heat dissipators only.

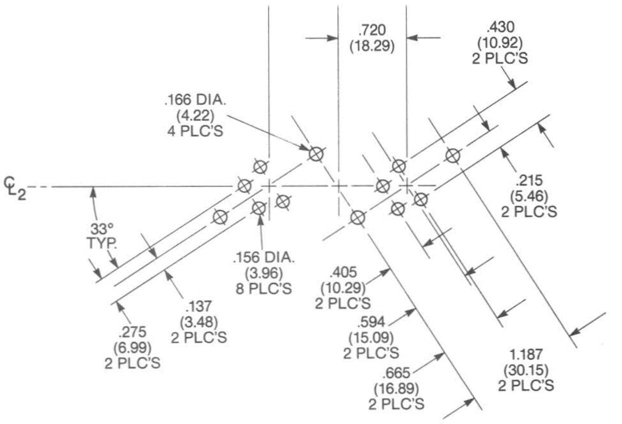


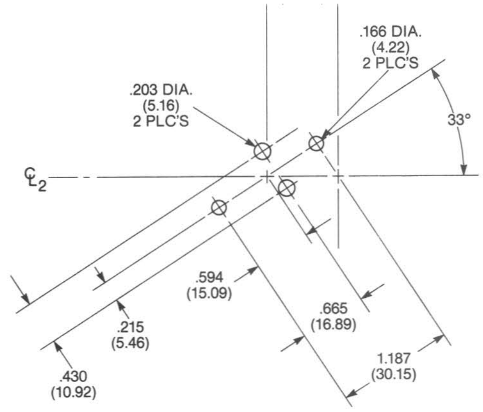
34. Hole pattern no. 201 accommodates two TO-66 ICs. Available in HP1 and HP3 series heat dissipators only.



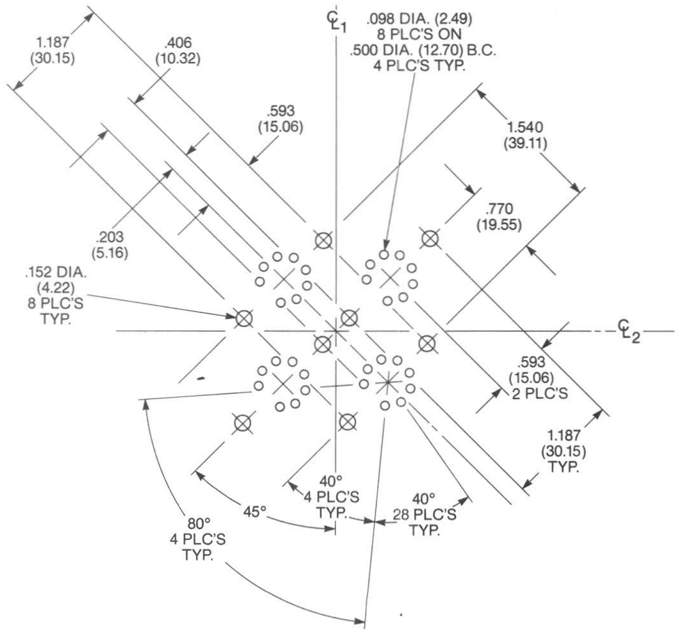
35. Hole pattern no. 203 accommodates three TO-66 ICs. Available in HP1 and HP3 series heat dissipators only.







38. Hole pattern no. 298 accommodates four TO-3 ICs. Available in HP3 series heat dissipators only.



SECTION 2

HEAT DISSIPATORS FOR PLASTIC CASE, LEAD-MOUNTED SEMICONDUCTORS

The index on the left is arranged according to increasing power dissipation capability (decreasing thermal resistance), while the index on the right lists dissipators in order of board area requirements and dissipator height.

Using the indices, it becomes a simple matter to locate a number of dissipators with similar, desirable thermal specifications; or to compare respective dimensions to determine the specific dissipator suited to your particular packaging requirements.

All thermal resistance data contained in these indices (unless otherwise noted) is based on 75°C case temperature rise above ambient in natural convection, and at 50°C case a suitable dissipator and should not be used to predict actual thermal performance.

The IERC dissipators illustrated in this section can solve a wide variety of thermal-management problems, when they are chosen carefully. Features and detailed descriptions of the individual dissipators are located in the appropriate areas within the section.

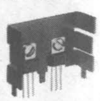
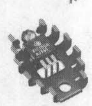
In order to select the proper heat dissipator for a particular application, simply follow the procedure outlined below to determine the correct part number.

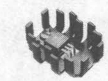
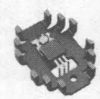
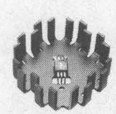
1. Determine maximum anticipated power dissipation.
2. Determine maximum allowable temperature the maximum operating junction temperature and the thermal resistance from junction to case (θ_{jc}) from the semiconductor manufacturer's data sheet. The maximum case temperature is the maximum junction temperature minus the product of the thermal resistance junction-to-case and the maximum power dissipation anticipated.

$$T_c = T_j - \theta_{j\text{-}c} P_{diss}$$

It is frequent practice to hold the case temperature to less than the maximum allowable temperature in order to increase component reliability. For a more detailed explanation, see "Principles of

INDEX BY THERMAL RESISTANCE

Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Mounting Envelope LxWxH (inches)	Page
Free-standing Clip-On 	PSC2	40.5	10.5	N/A	2-6—2-8
	PA2-7[1]	32.6	10.0	N/A	2-9
	PA1-7[1]	29.2	9.2	N/A	2-9
Vertical Board-Mounted 	PSB2	25.4	6.8	N/A	2-10
	PB1-36	20.0	5.7	N/A	2-10
	PSE1[2,5]	15.0	4.2	N/A	2-12
	PSD1	14.5	4.6	N/A	2-11
Horizontal Board-Mounted  	PA2[3]	30.0	10.2	.71 x 1.00 x .31	2-5
	PC1	27.3	9.6	.75 x .75 x .38	2-4
	PA1[3]	26.8	8.6	.71 x 1.00 x .50	2-4
	PB2[3]	25.0	8.1	1.18 x 1.00 x .31	2-6
	LA—A1	25.0	8.0	1.31 x .90 x .25	2-15
	PB1[3]	22.1	6.9	1.18 x 1.00 x .50	2-5
	LB—B2	20.8	6.4	1.40 x 1.12 x .31	2-14

Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Mounting Envelope LxWxH (inches)	Page
Horizontal Board-Mounted (cont.)     	LA—A2	20.0	6.2	1.31 x .90 x .50	2-15
	LA—A3	17.0	5.0	1.31 x .90 x .75	2-16
	LB—B1	16.5	5.2	1.40 x 1.12 x .50	2-14
	LA—B7	16.3	5.3	1.63 x 1.29 x .40	2-17
	LA—B2	15.0	5.0	1.63 x 1.29 x .50	2-17
	UP3[5]	15.0	4.4	1.50 x 1.38 x .44	2-19
	LA—A4	14.7	4.2	1.31 x .90 x 1.00	2-16
	LA—B3	12.9	4.2	1.63 x 1.29 x .75	2-18
	UP1[5]	11.7	3.6	1.78 x 1.78 x .50	2-20
	LA—B4	11.4	3.6	1.63 x 1.29 x 1.00	2-18
	LA—B5	9.7	3.3	1.63 x 1.29 x 1.25	2-19
	UP2[5]	9.4	3.2	1.78 x 1.78 x .75	2-21
	UP[5]	8.2	2.9	1.78 x 1.78 x 1.00	2-22
	UP10[2,5]	7.5	2.2	3.38 x 1.40 x .44	2-23
	HP1[4,5]	6.5	2.5	2.50 x 2.50 x .90	2-24
	HP3[3,5]	5.0	2.2	3.13 x 3.13 x 1.00	2-25

Notes: [1] TO-202 Transistor, 70°C and 40°C rises.
[2] Average case temperature divided by total power dissipation for two TO-220s.
[3] θ for unplated part.
[4] Thermal resistances based on 60°C case rise in natural convection and 30°C case rise in forced air (1000 fpm).
[5] Dissipator will accommodate more than one device. Please see ordering information and technical data on multiple device mounting on pages following this part in the catalog.

Thermal Management" in this catalog.

3. Determine allowable thermal resistance from case-to-ambient by dividing allowable temperature rise by the maximum power dissipation (°C/W).
4. Determine desired mounting orientation, either free standing, vertical mount (for minimum board space) or horizontal (board) mount.
5. Determine whether you wish to mount two or more semiconductors on one sink for thermal matching and space utilization. One dissipator for two semiconductors often uses less space than two heat sinks.
6. Will the dissipator be used in natural convection or forced air — if so, at what velocity? Dissipator efficiency can be greatly increased when forced air is used (See index, this page).
7. Select a dissipator from the thermal resistance table below and turn to the page indicated. From the graph of case temperature rise above ambient determine actual case temperature for given power dissipation. You will note that heat dissipator thermal resistance can vary with power level and dissipator temperature. Is this temperature rise acceptable? If not, consult the thermal resistance index to find a dissipator with a slightly lower thermal resistance. If you must maintain a specific board area requirement select a more effective, i.e., taller dissipator from the Index by Board Area and then make your final selection based upon the performance curves supplied with each part in the catalog.
8. From the ordering information select the hole pattern (if applicable) and finish desired. Note that an unplated part will run hotter than a black anodized part in natural convection by the amount given in the rating factors.

Other factors regarding dissipator efficiency and selection parameters are covered in "Principles of Thermal Management."

The following example illustrates this simple procedure.

Problem: To cool a TO-220 transistor that will dissipate 7.5 watts. From the transistor data sheet we determine that:

T_J max. $= 150°C$ and $\theta_{J\text{-}c} = 4.2°C/W$

Max. Case Temp. $= 150 - (7.5)(4.2) = 118°C$

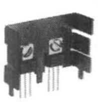
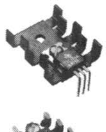
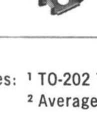
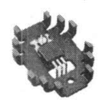
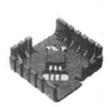
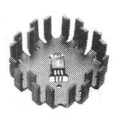
For increased reliability and a safety factor, we set the design case temperature at 100°C. A design ambient of 50° is set. Therefore, max. allowable temperature rise is 50°C. This makes the max. allowable thermal resistance

$$\frac{50°C}{7.5W} = 6.7°C/W$$

No forced air is available so the design must be for natural convection. Looking down the index shows we cannot use a free-standing or vertically mounted heat sink. (Note that if 1000 fpm forced air was available we could use a small vertical mount heat dissipator.) In the board-mount section the HP1 series looks promising. Turning to page 2-24 we see from the curve that at 7.5 watts dissipation the case temperature rise above ambient is 50°C — exactly the design temperature. (This will not always work out so well.)

From the ordering information we determine that for a TO-220 the correct hole pattern and part number is HP1-TO127. For the finish, a black anodize is desired but since this is not a military application, a commercial black anodize should be specified to reduce cost. Thus, the complete part number is HP1-TO127-CB.

INDEX BY BOARD AREA REQUIREMENTS

Heat Dissipator Configuration	Part Series	Mounting Envelope LxWxH (inches)	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page
Free-standing Clip-On 	PSC2	N/A	40.5	10.5	2-6—2-8
	PA2-7[1]	N/A	32.6	10.0	2-9
	PA1-7[1]	N/A	29.2	9.2	2-9
Vertical Board-Mounted 	PSB2	N/A	25.4	6.8	2-10
	PSD1	N/A	14.5	4.6	2-11
	PB1-36	N/A	20.0	5.7	2-10
	PSE1[2,5]	N/A	15.0	4.2	2-12
Horizontal Board-Mounted  	PC1	.75 x .75 x .38	27.3	9.6	2-4
	PA2[3]	.71 x 1.00 x .31	30.0	10.2	2-5
	PA1[3]	.71 x 1.00 x .50	26.8	8.6	2-4
	LA—A1	1.31 x .90 x .25	25.0	8.0	2-15
	LA—A2	1.31 x .90 x .50	20.0	6.2	2-15
	LA—A3	1.31 x .90 x .75	17.0	5.0	2-16
	LA—A4	1.31 x .90 x 1.00	14.7	4.2	2-16
Horizontal Board-Mounted (cont.)     	PB2[3]	1.18 x 1.00 x .31	25.0	8.1	2-6
	PB1[3]	1.18 x 1.00 x .50	22.1	6.9	2-5
	LB—B2	1.40 x 1.12 x .31	20.8	6.4	2-14
	LB—B1	1.40 x 1.12 x .50	16.5	5.2	2-14
	UP3[5]	1.50 x 1.38 x .44	15.0	4.4	2-19
	LA—B7	1.63 x 1.29 x .40	16.3	5.3	2-17
	LA—B2	1.63 x 1.29 x .50	15.0	5.0	2-17
	LA—B3	1.63 x 1.29 x .75	12.9	4.2	2-18
	LA—B4	1.63 x 1.29 x 1.00	11.4	3.6	2-18
	LA—B5	1.63 x 1.29 x 1.25	9.7	3.3	2-19
	UP1[5]	1.78 x 1.78 x .50	11.7	3.6	2-20
	UP2[5]	1.78 x 1.78 x .75	9.4	3.2	2-21
	UP[5]	1.78 x 1.78 x 1.00	8.2	2.9	2-22
	UP10[2,5]	3.38 x 1.40 x .44	7.5	2.2	2-23
	HP1[4,5]	2.50 x 2.50 x .90	6.5	2.5	2-24
	HP3[4,5]	3.13 x 3.13 x 1.00	5.0	2.2	2-25

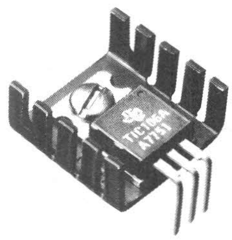
Notes: [1] TO-202 Transistor, 70°C and 40°C rises.
[2] Average case temperature divided by total power dissipation for two TO-220s.
[3] θ for unplated part.
[4] Thermal resistances based on 60°C case rise in natural convection and 30°C case rise in forced air (1000 fpm).
[5] Dissipator will accommodate more than one device. Please see ordering information and technical data on multiple device mounting on pages following this part in the catalog.

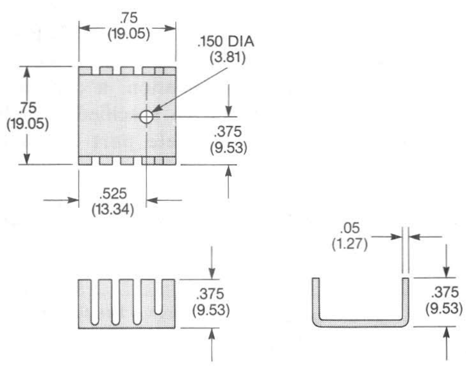
HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

Horizontally mounted, light-weight, low-cost heat dissipators

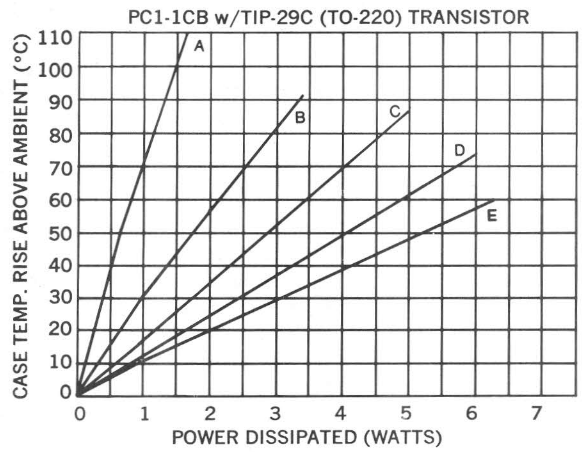
- Accommodates all flat plastic case power semiconductors.
- Efficient design requires just .71 sq. in. of board area (PA Series) and .31″ to .5″ height above board.
- Larger PB Series offers greater heat dissipation, additional hole patterns, and dual semiconductor mounting capability.
- Only one mounting screw required to secure dissipators to semiconductor and circuit board.
- Most effective heat dissipator in performance/unit cost.

PC1-1CB





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

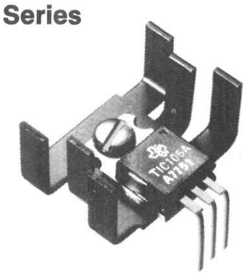
A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

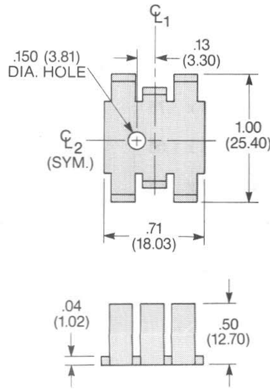
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 2.4 °C/watt for unplated part in natural convection only.

Ordering Information

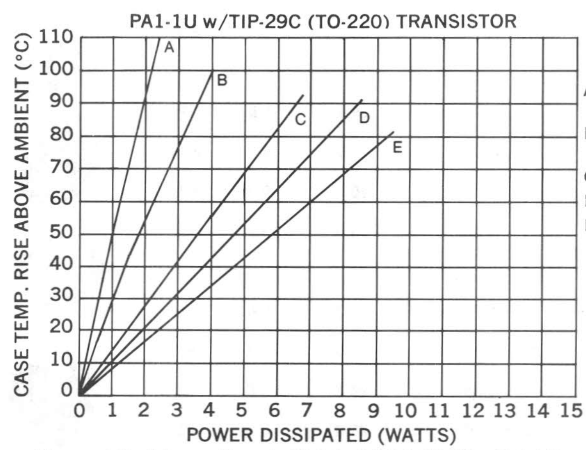
IERC PART NO.			Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize		
PC1-1U	PC1-1CB	PC1-1B	TO-126, TO-127, TO-220	1.9

PA1 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

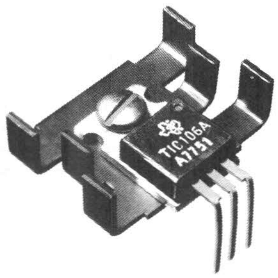
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt for black part in natural convection only.
- Derate 0.6 °C/watt for Insulube® part in natural convection only.

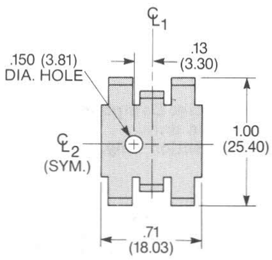
Ordering Information

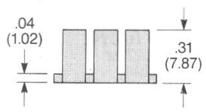
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Com'l. Black Anodize	Mil. Black Anodize	Insulube® 448		
PA1U	PA1CB	PA1B	PA1	Undrilled	2.0
PA1-1U	PA1-1CB	PA1-1B	PA1-1	TO-126, TO-127, TO-220	2.0

Note: See page iv for other finishes.

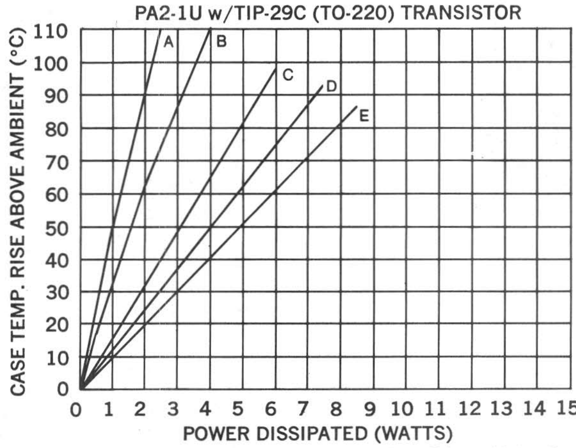
PA2 Series







PA2-1U w/TIP-29C (TO-220) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt for black part in natural convection only.
- Derate 0.6 °C/watt for Insulube® part in natural convection only.

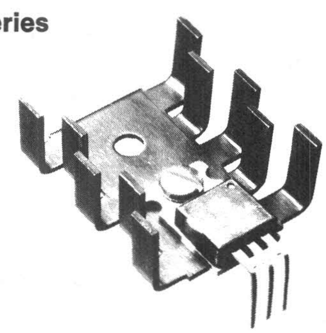
Ordering Information

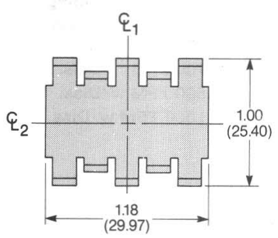
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Com'l. Black Anodize	Mil. Black Anodize	Insulube® 448		
PA2U	PA2CB	PA2B	PA2	Undrilled	1.5
PA2-1U	PA2-1CB	PA2-1B	PA2-1	TO-126, TO-127, TO-220	1.5

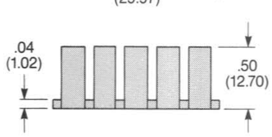
Note: See page iv for other finishes.

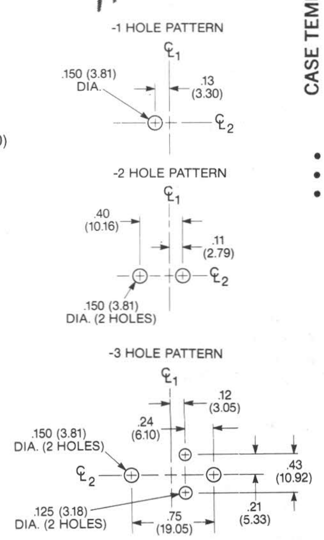
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

PB1 Series



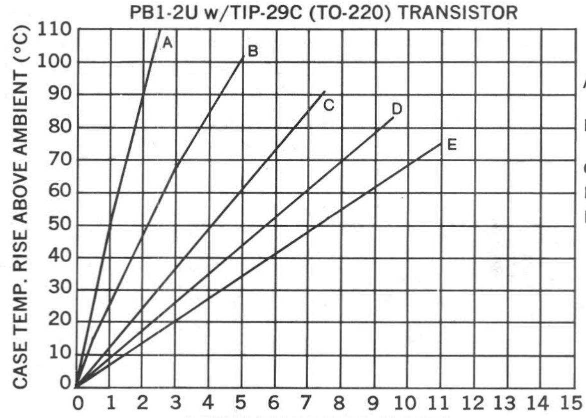






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

PB1-2U w/TIP-29C (TO-220) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt for black part in natural convection only.
- Derate 0.6 °C/watt for Insulube® part in natural convection only.

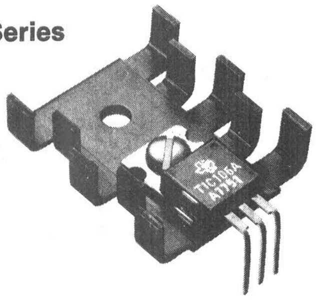
Ordering Information

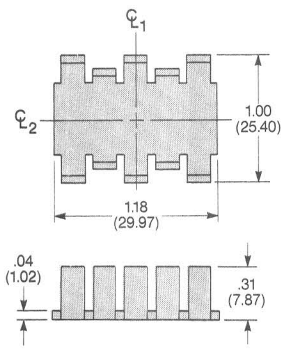
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Com'l. Black Anodize	Mil. Black Anodize	Insulube® 448		
PB1U	PB1CB	PB1B	PB1	Undrilled	3.0
PB1-1U	PB1-1CB	PB1-1B	PB1-1	One TO-126, TO-127 or TO-220	3.0
PB1-2U	PB1-2CB	PB1-2B	PB1-2	One or two TO-126, TO-127 or TO-220	3.0
PB1-3U	PB1-3CB	PB1-3B	PB1-3	F-36 or MS9	3.0

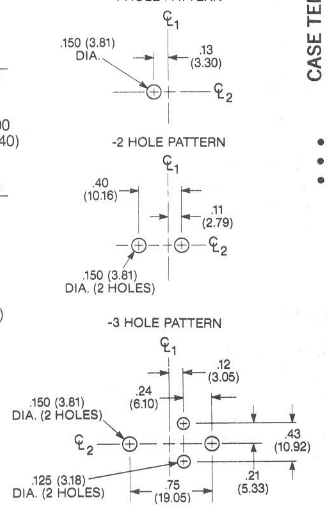
Note: See page iv for other finishes.

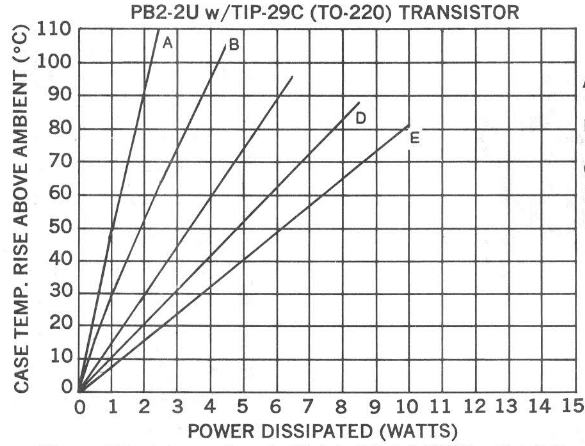
HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

PB2 Series









DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt for black part in natural convection only.
- Derate 0.6 °C/watt for Insulube® part in natural convection only.

Ordering Information

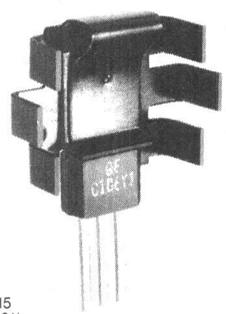
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Com'l. Black Anodize	Mil. Black Anodize	Insulube® 448		
PB2U	PB2CB	PB2B	PB2	Undrilled	2.5
PB2-1U	PB2-1CB	PB2-1B	PB2-1	One TO-126, TO-127 or TO-220	2.5
PB2-2U	PB2-2CB	PB2-2B	PB2-2	One or two TO-126, TO-127 or TO-220	2.5
PB2-3U	PB2-3CB	PB2-3B	PB2-3	F-36 or MS9	2.5

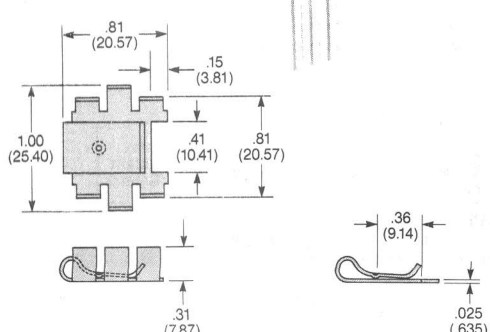
Note: See page iv for other finishes.

Free-standing, one-piece, clip-on heat dissipators

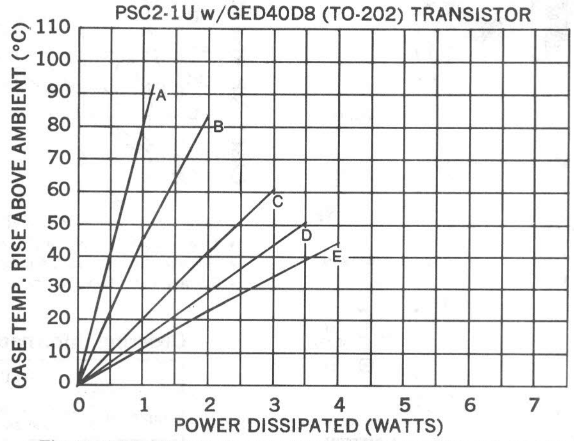
- Requires no physical board area.
- Excellent for retrofitting to existing design for additional cooling.
- Easy clip-on design allows secure fit with semiconductor—no mounting hardware or special tools required.
- Optimized clamping action and positive-stop dimple holds semiconductor in place providing an efficient thermal interface for maximum heat dissipation.
- Anti-rotation tabs available for TO-220, TO-126 or TO-127 dissipators.
- Permits semiconductor and dissipator to function as a free-standing assembly.
- Light-weight design minimizes stress on component.

PSC2-1





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

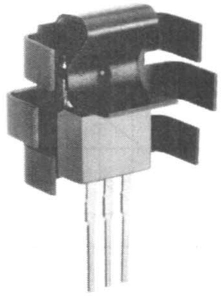
A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

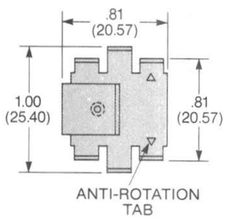
- Thermal Resistance Case to Sink is 1.4-1.6 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt per device for black part in natural convection only.

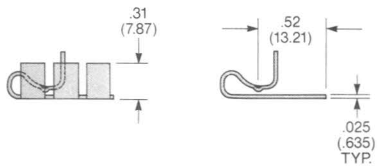
Ordering Information

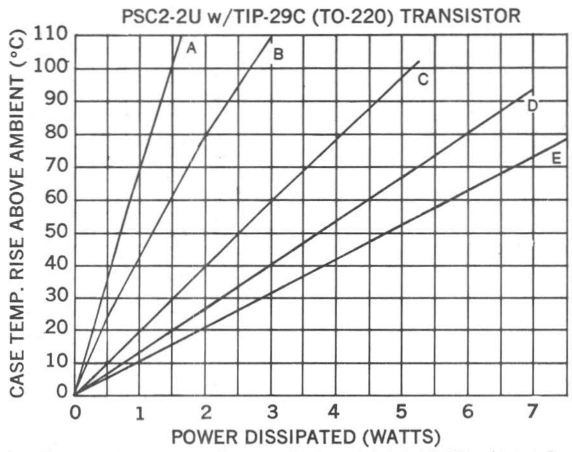
IERC PART NO.		Semiconductor Accommodated	Max. Weight (Grams)	Anti-Rotation Tabs
Unplated	Comm'l. Black Anodize			
PSC2-1U	PSC2-1CB	TO-202	1.4	N/A

PSC2-2









DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

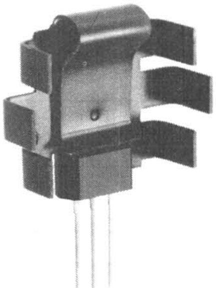
- Thermal Resistance Case to Sink is 1.1-1.3 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt for black part in natural convection only.

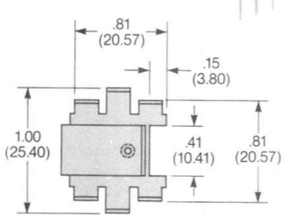
Ordering Information

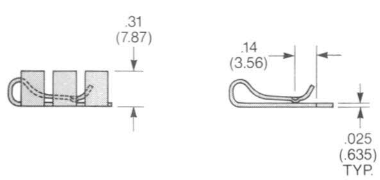
IERC PART NO.		Semiconductor Accommodated	Max. Weight (Grams)	Anti-Rotation Tabs
Unplated	Comm'l. Black Anodize			
PSC2-2U	PSC2-2CB	TO-220	1.4	No
PSC2T-2U	PSC2T-2CB	TO-220	1.4	Yes

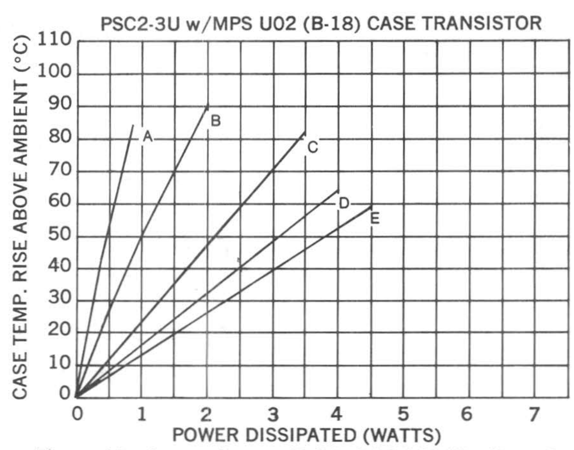
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

PSC2-3









DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.2-2.9 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt per device for black part in natural convection only.

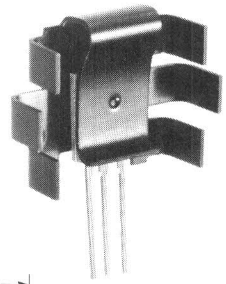
Ordering Information

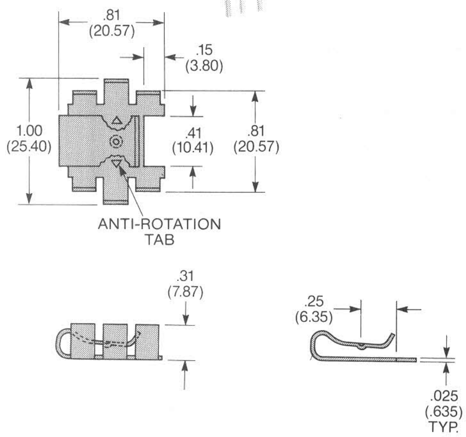
IERC PART NO.		Semiconductor Accommodated	Max. Weight (Grams)	Anti-Rotation Tabs
Unplated	Comm'l. Black Anodize			
PSC2-3U	PSC2-3CB	Motorola Case 152	1.4	N/A

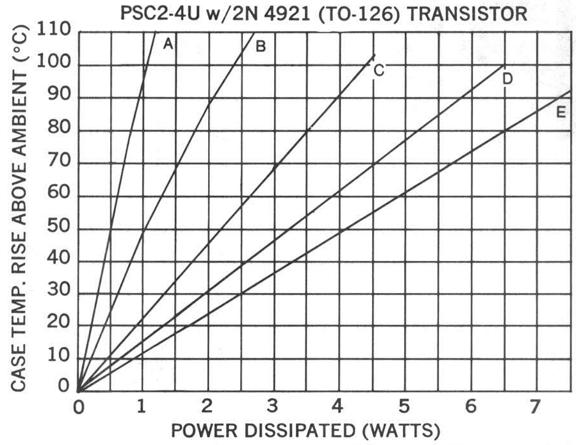
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

PSC2-4







DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

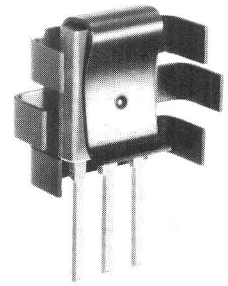
- Thermal Resistance Case to Sink is 1.1-1.3 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt per device for black part in natural convection only.

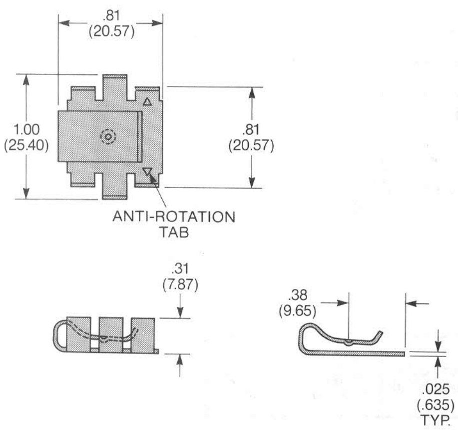
Ordering Information

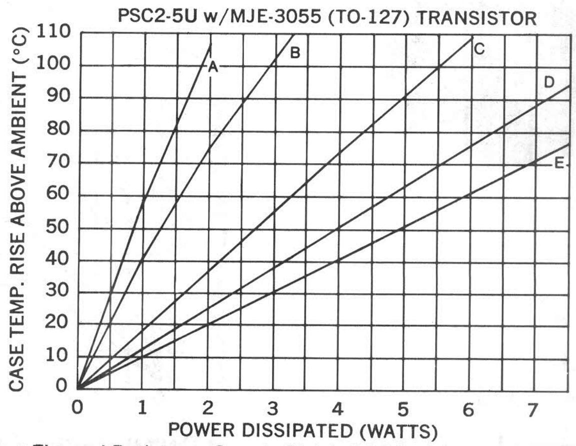
IERC PART NO.		Semiconductor Accommodated	Max. Weight (Grams)	Anti-Rotation Tabs
Unplated	Comm'l. Black Anodize			
PSC2-4U	PSC2-4CB	TO-126	1.4	No
PSC2T-4U	PSC2T-4CB	TO-126	1.4	Yes

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

PSC2-5







DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.8-1.0 °C/W w/Joint Compound.
- Uprate 2.4 °C/watt per device for black part in natural convection only.

Ordering Information

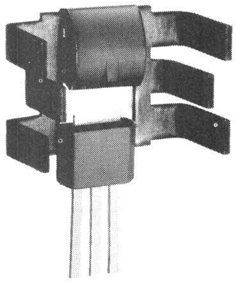
IERC PART NO.		Semiconductor Accommodated	Max. Weight (Grams)	Anti-Rotation Tabs
Unplated	Comm'l. Black Anodize			
PSC2-5U	PSC2-5CB	TO-127	1.4	No
PSC2T-5U	PSC2T-5CB	TO-127	1.4	Yes

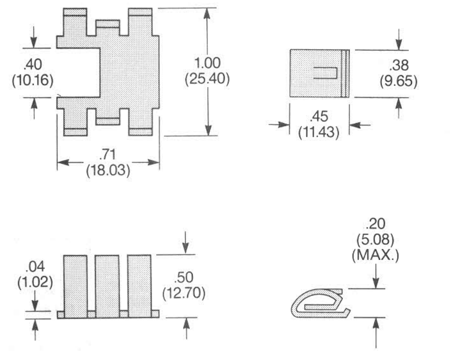
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Free-standing heat dissipator and clip assembly

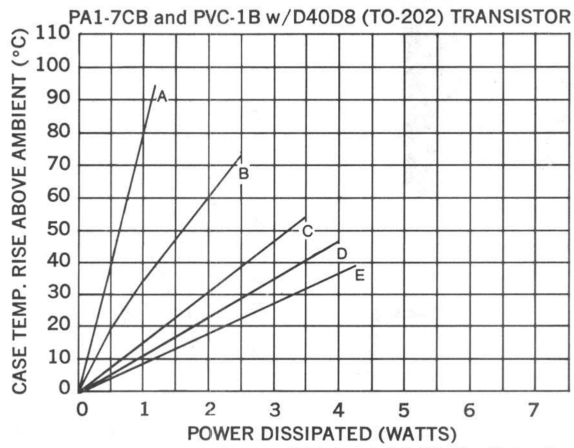
- Beryllium copper clip is designed to provide high clamping pressure, which assures low thermal resistance between dissipator and semiconductor, allowing a 150% power increase in natural convection to more than 400% in forced air.
- Clip may be used alone to attach semiconductor to a customer designed heat conduction plane.
- Free-standing assembly can be mounted either vertically or horizontally on board — requires no special tools or mounting hardware.
- Clip's spring design firmly attaches to device and dissipator, stays attached even in severe shock and vibration environments.

PA1-7





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

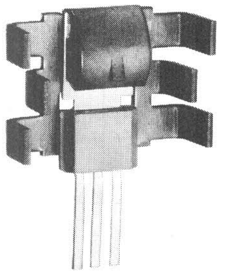
A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

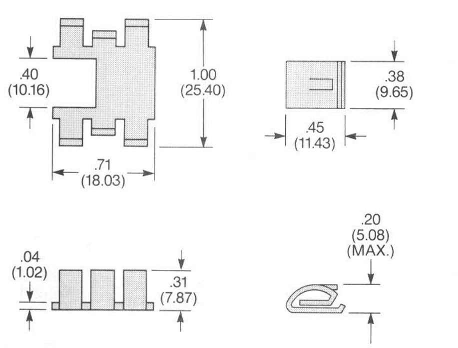
- Thermal Resistance Case to Sink is 1.1-1.3 °C/W w/Joint Compound.
- Derate 2.4 °C/watt for unplated part in natural convection only.

Ordering Information

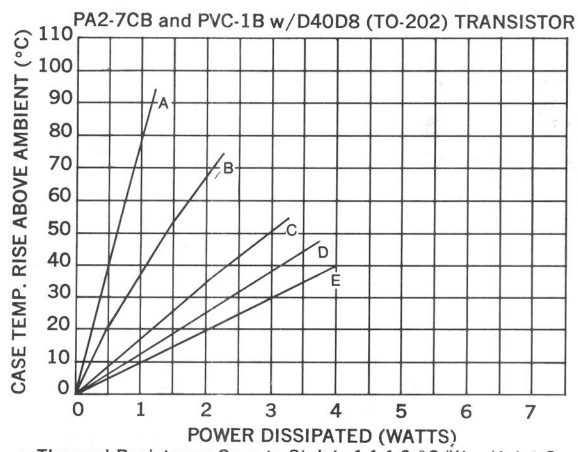
ITEM	IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
	Unplated	Black Cadmium	Comm'l. Black Anodize	Mil. Black Anodize		
Dissipator	PA1-7U	N/A	PA1-7CB	PA1-7B	TO-202	2.0
Clip	PVC-1U	PVC-1B	N/A	N/A	TO-202	0.7

PA2-7





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 1.1-1.3 °C/W w/Joint Compound.
- Derate 2.4 °C/watt for unplated part in natural convection only.

Ordering Information

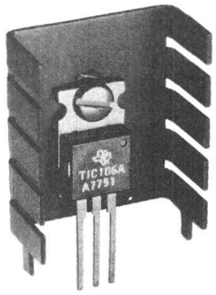
ITEM	IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
	Unplated	Black Cadmium	Comm'l. Black Anodize	Mil. Black Anodize		
Dissipator	PA2-7U	N/A	PA2-7CB	PA2-7B	TO-202	1.5
Clip	PVC-1U	PVC-1B	N/A	N/A	TO-202	0.7

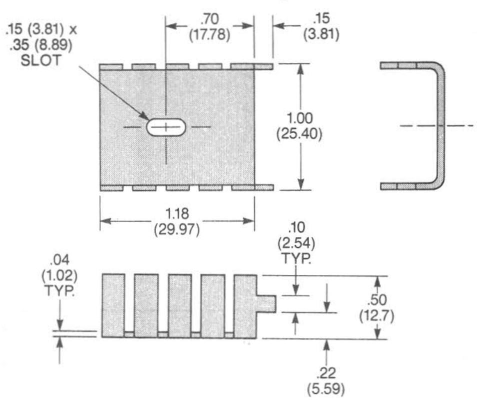
HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

Vertically mounted heat dissipators with board mounting tabs

- Permits higher power levels or lower operating temperatures while occupying a minimum of valuable board space.
- Allows back-to-back dual mounting for thermal matching applications.
- Bendable tabs simplify installation to the circuit board — no mounting hardware or special tools required.
- Dissipators are available with nickel or tin finishes — allows heat sink mounting tabs to be flow-soldered onto board along with other components.
- Each dissipator is optimally designed for maximum effective surface area in a minimum working envelope.

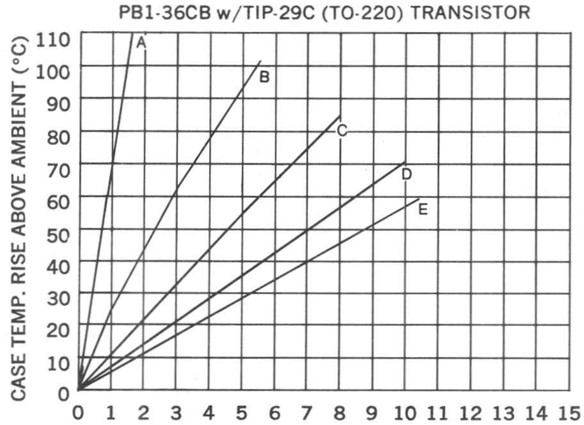
PB1-36 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

PB1-36CB w/TIP-29C (TO-220) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

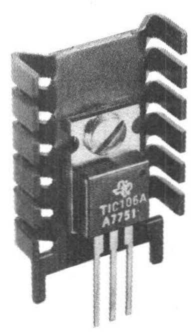
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 2.4 °C/watt for unplated part in natural convection only.

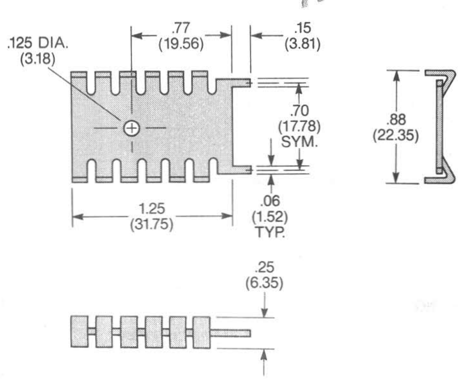
Ordering Information

IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
			Solderable Plating			
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Nickel	Tin		
PB1-36U	PB1-36CB	PB1-36B	PB1-36ND	PB1-36T	TO-126, TO-127, TO-220	3.9

Note: See page iv for other finishes.

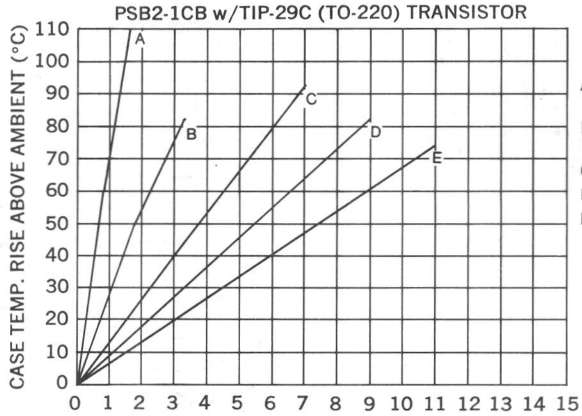
PSB2-1 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

PSB2-1CB w/TIP-29C (TO-220) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

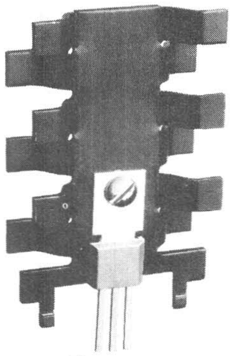
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 3.5 °C/watt for unplated part in natural convection only.

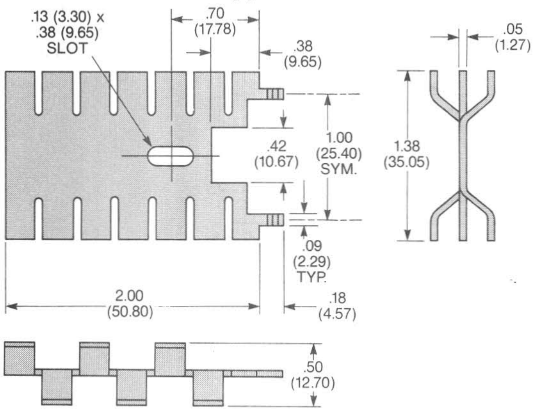
Ordering Information

IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
			Solderable Plating			
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Nickel	Tin		
PSB2-1U	PSB2-1CB	PSB2-1B	PSB2-1ND	PSB2-1T	TO-126, TO-127, TO-220	2.4

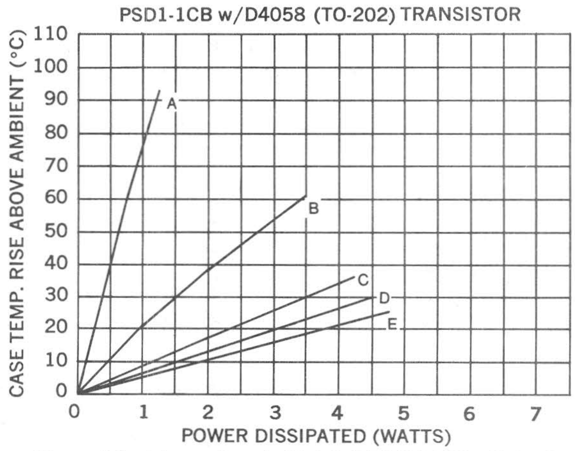
Note: See page iv for other finishes.

PSD1-1 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION
OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

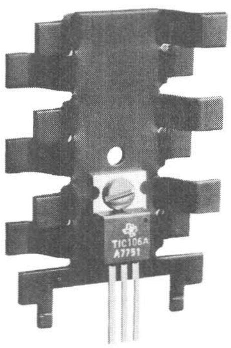
- Thermal Resistance Case to Sink is 1.1-1.3 °C/W w/Joint Compound.
- Derate 2.4 °C/watt per device for unplated part in natural convection only.

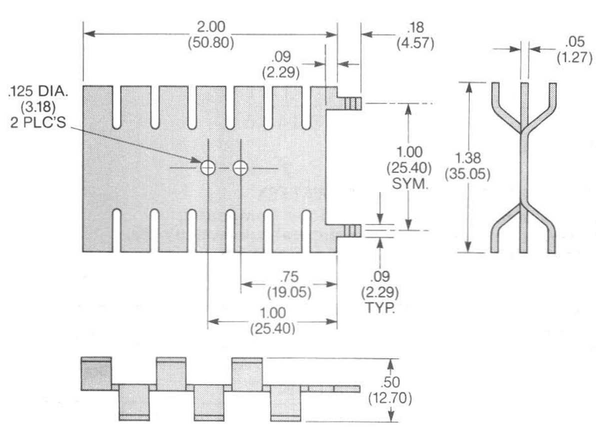
Ordering Information

IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
			Solderable Plating			
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Nickel	Tin		
PSD1-1U	PSD1-1CB	PSD1-1B	PSD1-1ND	PSD1-1T	TO-202	6.3

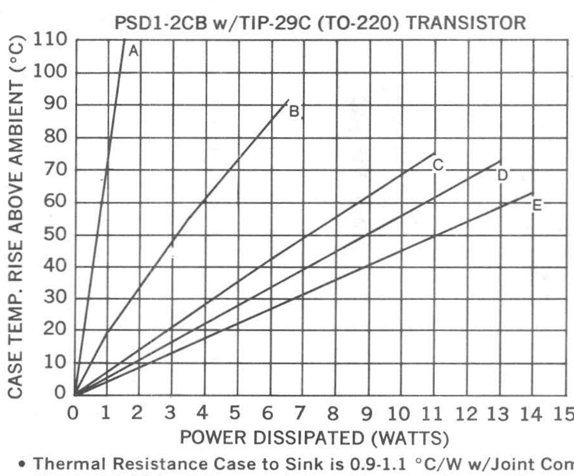
Note: See page iv for other finishes.

PSD1-2 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION
OF CURVES

A. N.C. Horiz. Device Only Freestanding.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 2.3 °C/watt for unplated part in natural convection only.

Ordering Information

IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
			Solderable Plating			
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Nickel	Tin		
PSD1-2U	PSD1-2CB	PSD1-2B	PSD1-2ND	PSD1-2T	TO-126, TO-127, TO-220	6.3

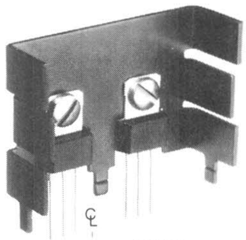
Note: See page iv for other finishes.

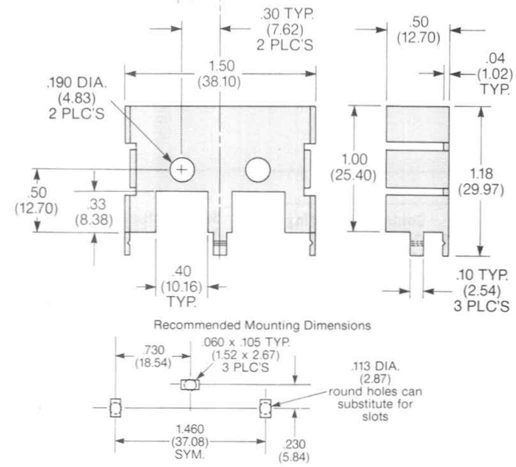
HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

Stand-up, dual-mounted heat dissipators

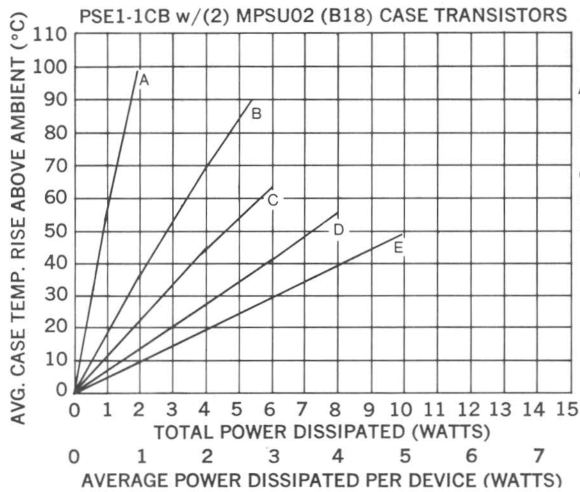
- Thermally matches two semiconductors within 2°C at equivalent power levels up to 9 watts per semiconductor, permitting paired semiconductors to function more nearly identical.
- Effective alternative to back-to-back semiconductor mounting; eliminates lead interferences.
- Minimizes board space requirements while providing effective heat dissipation.
- Bend relief notches on mounting tabs permit easy installation with no mounting hardware or special tools required.
- Each dissipator of this series is specifically designed for use with a particular transistor case type — performance and fit are optimized.

PSE1-1





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

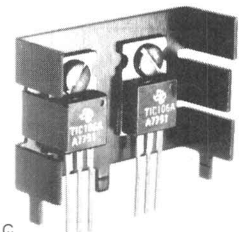
- Thermal Resistance Case to Sink is 1.9-2.3 °C/W w/Joint Compound.
- Derate 6.4 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

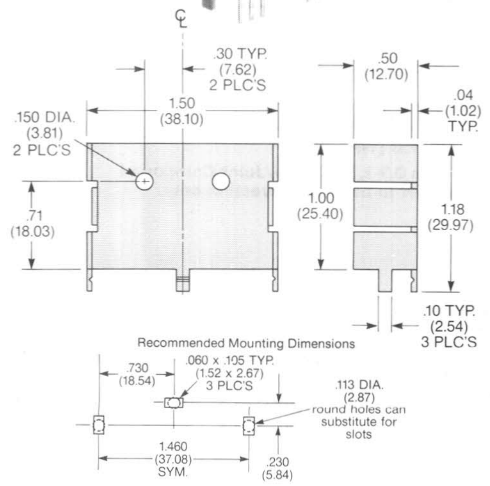
Ordering Information

IERC PART NO.						
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Nickel	Black Coating with Solderable Tabs	Semiconductor Accommodated	Max. Weight (Grams)
PSE1-1U	PSE1-1CB	PSE1-1B	PSE1-1ND	PSE1-1TCB	Two Motorola Case 152s	3.6

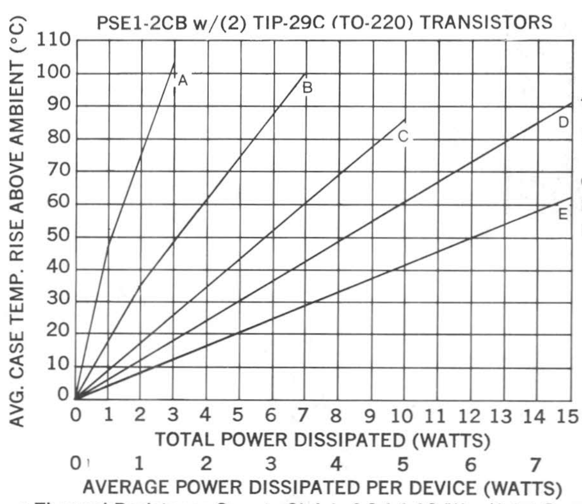
Note: See page iv for other finishes.

PSE1-2





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

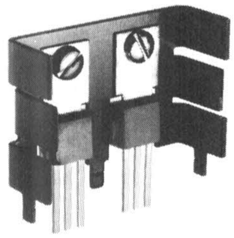
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 4.0 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

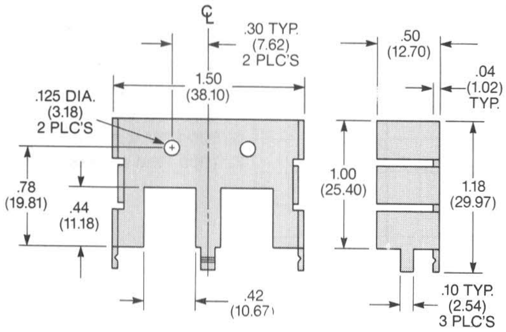
Ordering Information

IERC PART NO.						
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Nickel	Black Coating with Solderable Tabs	Semiconductor Accommodated	Max. Weight (Grams)
PSE1-2U	PSE1-2CB	PSE1-2B	PSE1-2ND	PSE1-2TCB	Two TO-126s, Two TO-127s, Two TO-220s	4.2

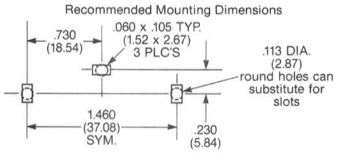
Note: See page iv for other finishes.

PSE1-3



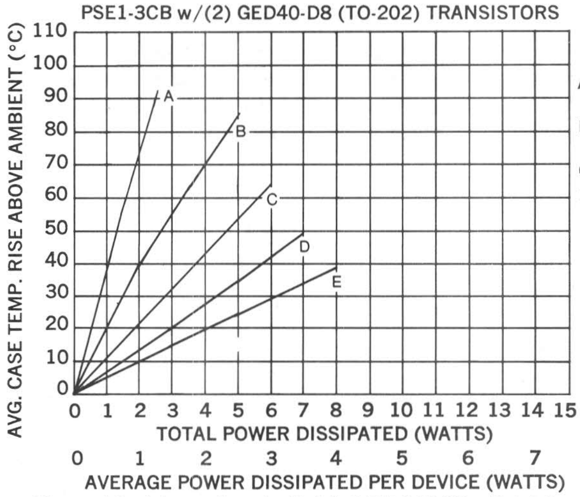


Recommended Mounting Dimensions



Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

PSE1-3CB w/(2) GED40-D8 (TO-202) TRANSISTORS



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

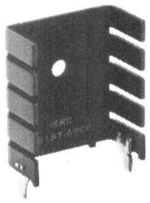
- Thermal Resistance Case to Sink is 1.5-2.0 °C/W w/Joint Compound.
- Derate 4.0 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

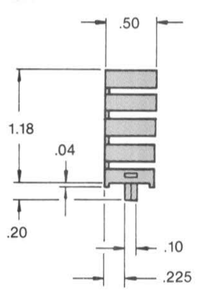
Ordering Information

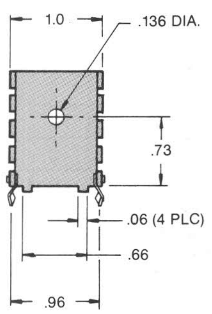
IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Nickel	Black Coating with Solderable Tabs		
PSE1-3U	PSE1-3CB	PSE1-3B	PSE1-3ND	PSE1-3TCB	Two TO-202s	3.5

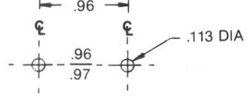
Note: See page iv for other finishes.

PB1ST-69 Solderable Tab Heat Dispenser







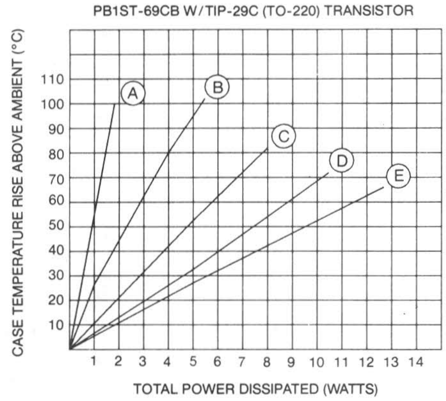


Recommended PCB Hole Pattern.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

THERMAL TEST RESULTS

PB1ST-69CB W/TIP-29C (TO-220) TRANSISTOR



A. N.C. G-10 Horiz without Dissipator
B. Natural Convection
C. 200fpm w/Diss.
D. 500fpm w/Diss.
E. 1000fpm w/Diss.

Complete functional and thermal test results are available upon request from the factory.

Ordering Information

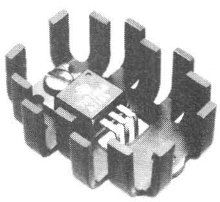
IERC Part Number		Semiconductors Accommodated	Max Weight (Grams)
Unplated	Black Anodized		
PB1ST-69U	PB1ST-69CB	TO126, TO127, TO220	4.0

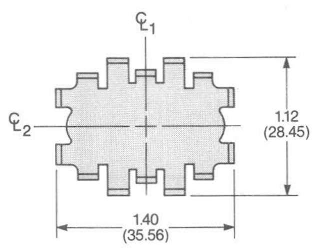
*Note: See page iv for other finishes

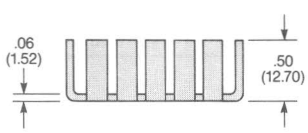
Board-mounted heat dissipators

- These compact, high-performance heat dissipators have exceptional volume/thermal efficiency ratios, making them especially effective where board space is limited and power levels are high.
- A wide range of hole patterns is available for single and multiple semiconductor mounting.
- Various finger heights in the LA, LB and UP Series optimize power dissipation, permit tailoring the heat dissipator to match vertical height requirements.

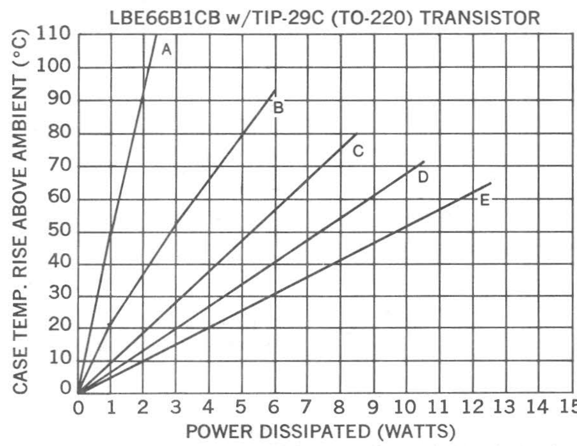
LB-B1 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES
A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

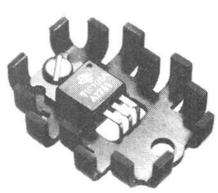
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.4 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

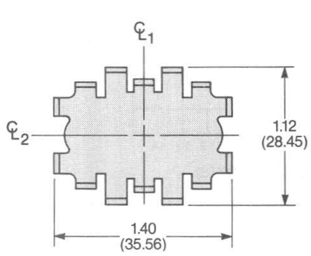
Ordering Information

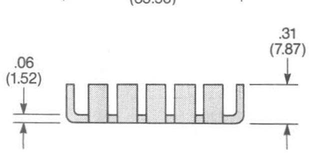
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LB66B1-76U	LB66B1-76CB	LB66B2-76B	LB66B1-76	Undrilled	—	6.2
LBE66B1U	LBE66B1CB	LBE66B1B	LBE66B1	TO-126, TO-220	1	6.2

Note: See page iv for other finishes.

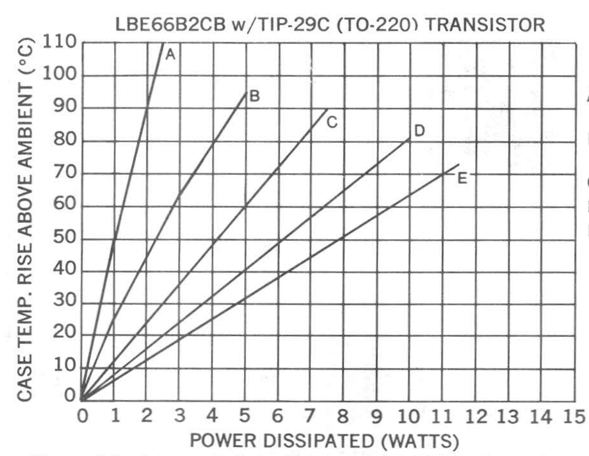
LB-B2 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES
A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

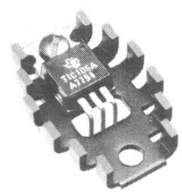
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.4 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

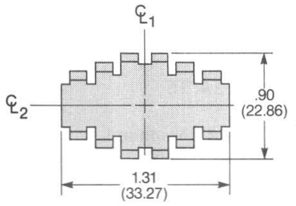
Ordering Information

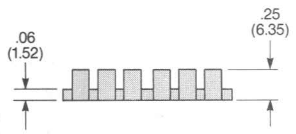
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LB66B2-76U	LB66B2-76CB	LB66B2-76B	LB66B2-76	Undrilled	—	4.8
LBE66B2U	LBE66B2CB	LBE66B2B	LBE66B2	TO-126, TO-220	1	4.8

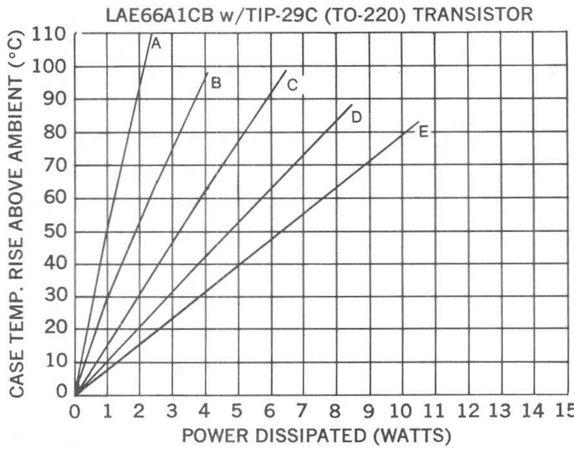
Note: See page iv for other finishes.

LA-A1 Series









DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.3 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

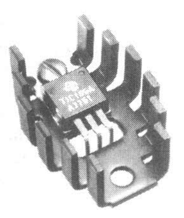
Ordering Information

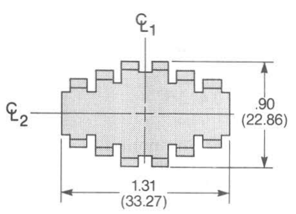
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000A1U	LA000A1CB	LA000A1B	LA000A1	Undrilled	—	3.1
LAE66A1U	LAE66A1CB	LAE66A1B	LAE66A1	TO-126, TO-220	1	3.1

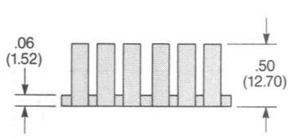
Note: See page iv for other finishes.

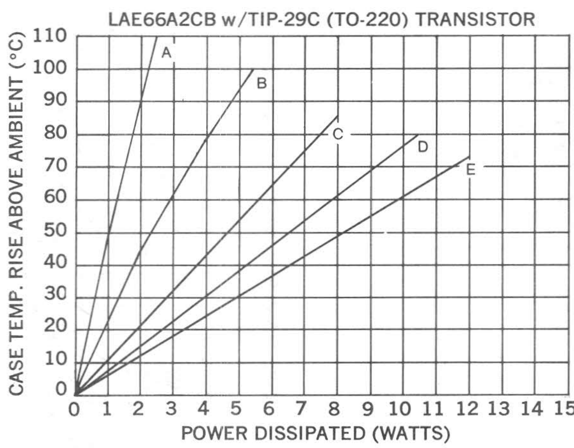
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LA-A2 Series









DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.4 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

Ordering Information

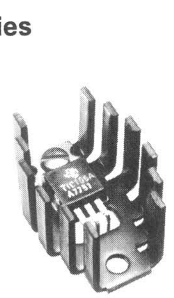
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000A2U	LA000A2CB	LA000A2B	LA000A2	Undrilled	—	4.6
LAE66A2U	LAE66A2CB	LAE66A2B	LAE66A2	TO-126, TO-220	1	4.6

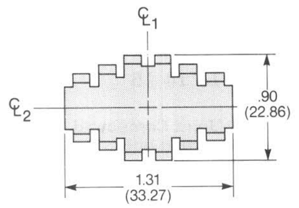
Note: See page iv for other finishes.

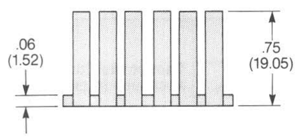
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

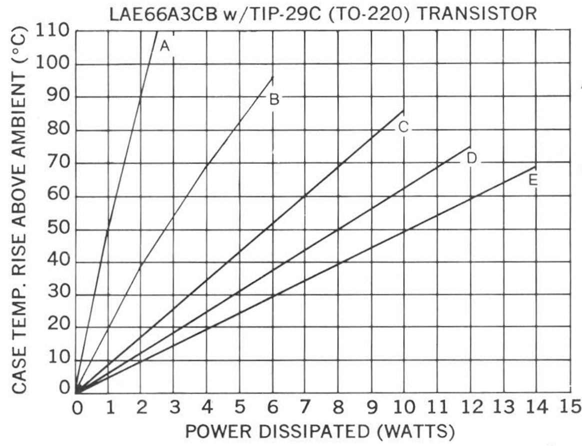
LA-A3 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

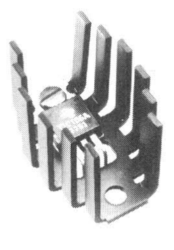
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.5 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

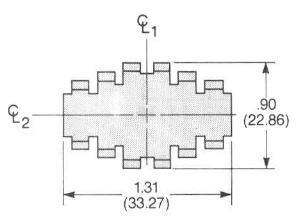
Ordering Information

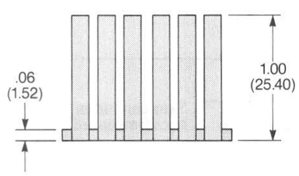
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000A3U	LA000A3CB	LA000A3B	LA000A3	Undrilled	—	6.1
LAE66A3U	LAE66A3CB	LAE66A3B	LAE66A3	TO-126, TO-220	1	6.1

Note: See page iv for other finishes.

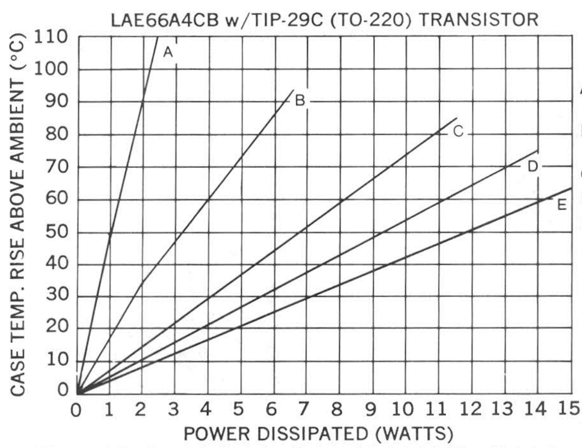
LA-A4 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

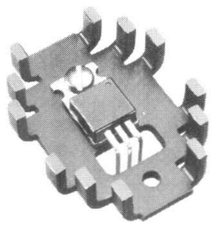
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

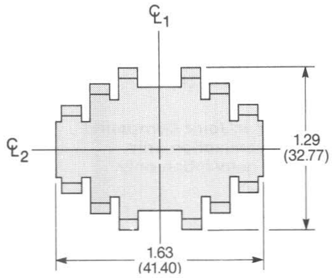
Ordering Information

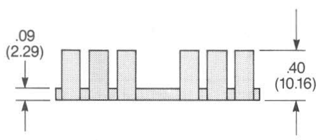
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000A4U	LA000A4CB	LA000A4B	LA000A4	Undrilled	—	7.6
LAE66A4U	LAE66A4CB	LAE66A4B	LAE66A4	TO-126, TO-220	1	7.6

Note: See page iv for other finishes.

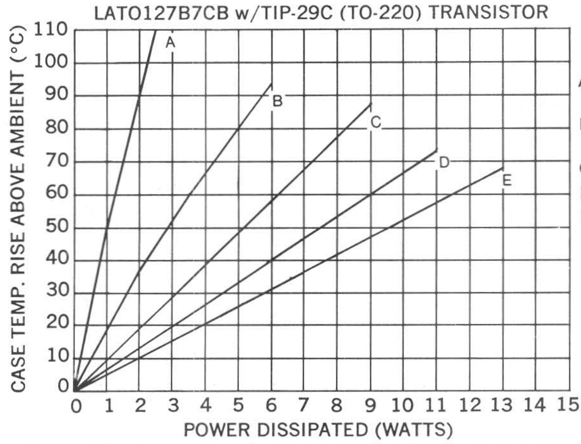
LA-B7 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

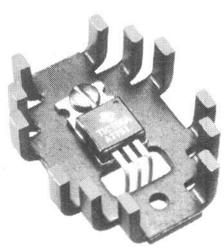
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

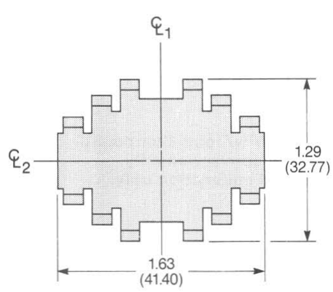
Ordering Information

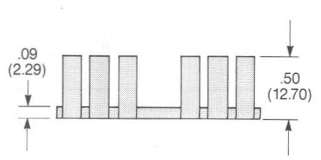
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B7U	LA000B7CB	LA000B7B	LA000B7	Undrilled	—	7.8
LATO126B7U	LATO126B7CB	LATO126B7B	LATO126B7	TO-126	2	7.8
LATO127B7U	LATO127B7CB	LATO127B7B	LATO127B7	TO-127, TO-220	3	7.8
LA394B7U	LA394B7CB	LA394B7B	LA394B7	Universal	4	7.8

Note: See page iv for other finishes.

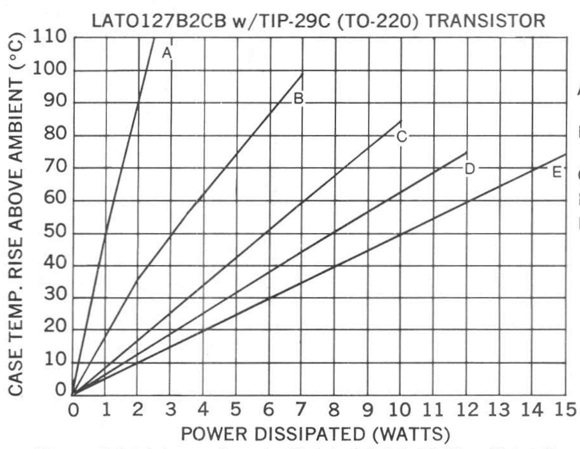
LA-B2 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

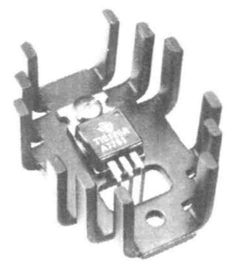
Ordering Information

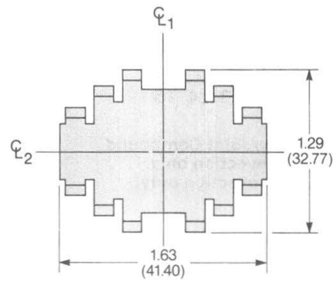
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B2U	LA000B2CB	LA000B2B	LA000B2	Undrilled	—	8.8
LATO126B2U	LATO126B2CB	LATO126B2B	LATO126B2	TO-126	2	8.8
LATO127B2U	LATO127B2CB	LATO127B2B	LATO127B2	TO-127, TO-220	3	8.8
LA394B2U	LA394B2CB	LA394B2B	LA394B2	Universal	4	8.8

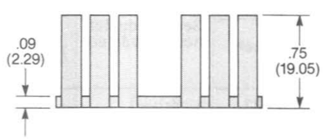
Note: See page iv for other finishes.

HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

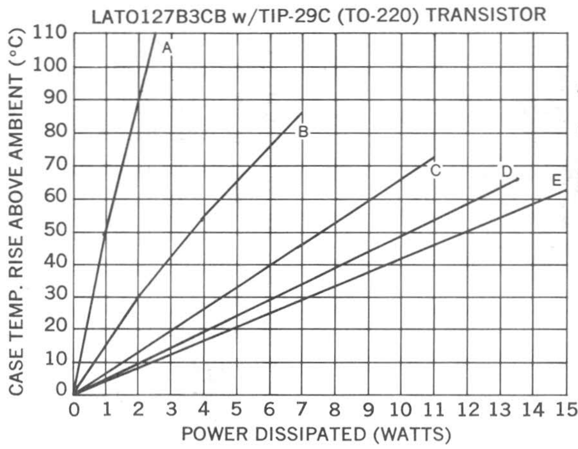
LA-B3 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

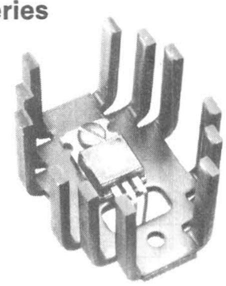
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

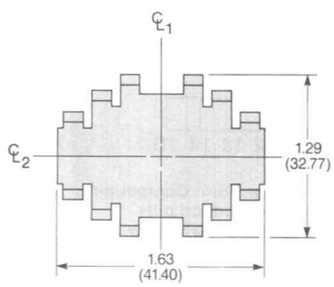
Ordering Information

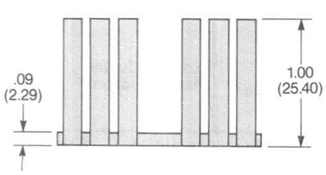
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B3U	LA000B3CB	LA000B3B	LA000B3	Undrilled	—	10.8
LAT0126B3U	LAT0126B3CB	LAT0126B3B	LAT0126B3	TO-126	2	10.8
LAT0127B3U	LAT0127B3CB	LAT0127B3B	LAT0127B3	TO-127, TO-220	3	10.8
LA394B3U	LA394B3CB	LA394B3B	LA394B3	Universal	4	10.8

Note: See page iv for other finishes.

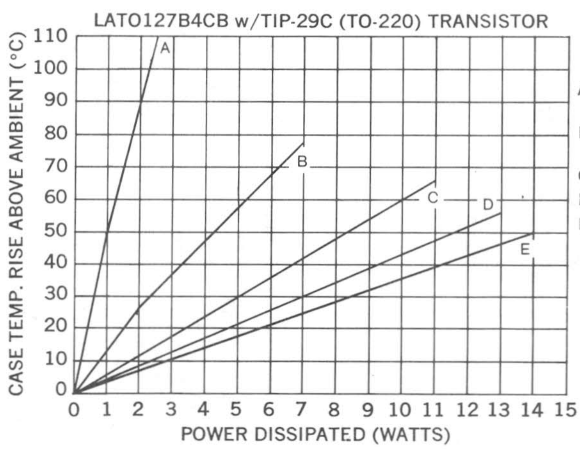
LA-B4 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

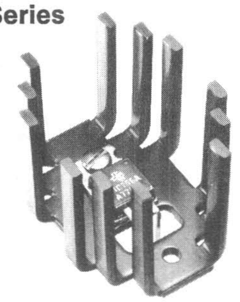
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

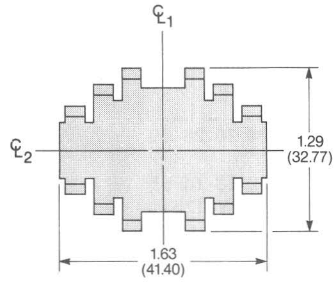
Ordering Information

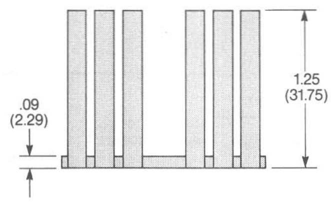
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B4U	LA000B4CB	LA000B4B	LA000B4	Undrilled	—	12.9
LAT0126B4U	LAT0126B4CB	LAT0126B4B	LAT0126B4	TO-126	2	12.9
LAT0127B4U	LAT0127B4CB	LAT0127B4B	LAT0127B4	TO-127, TO-220	3	12.9
LA394B4U	LA394B4CB	LA394B4B	LA394B4	Universal	4	12.9

Note: See page iv for other finishes.

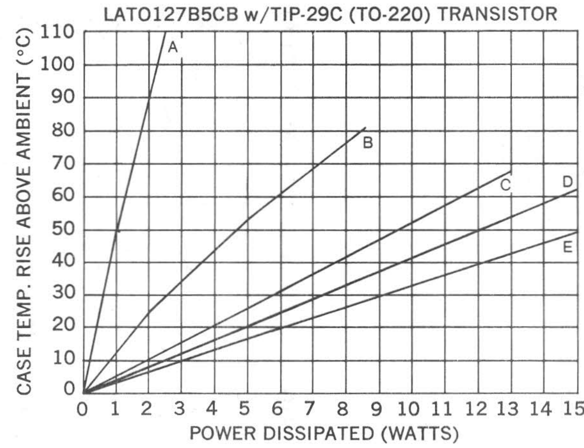
LA-B5 Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

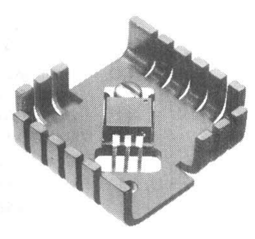
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

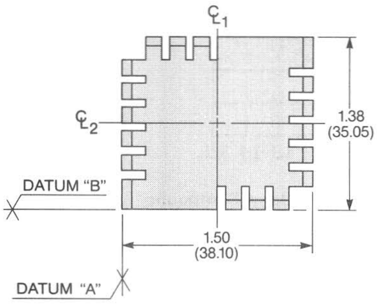
Ordering Information

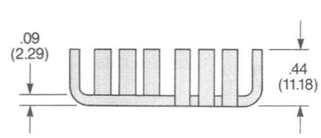
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
LA000B5U	LA000B5CB	LA000B5B	LA000B5	Undrilled	—	15.1
LATO126B5U	LATO126B5CB	LATO126B5B	LATO126B5	TO-126	2	15.1
LATO127B5U	LATO127B5CB	LATO127B5B	LATO127B5	TO-127, TO-220	3	15.1
LA394B5U	LA394B5CB	LA394B5B	LA394B5	Universal	4	15.1

Note: See page iv for other finishes.

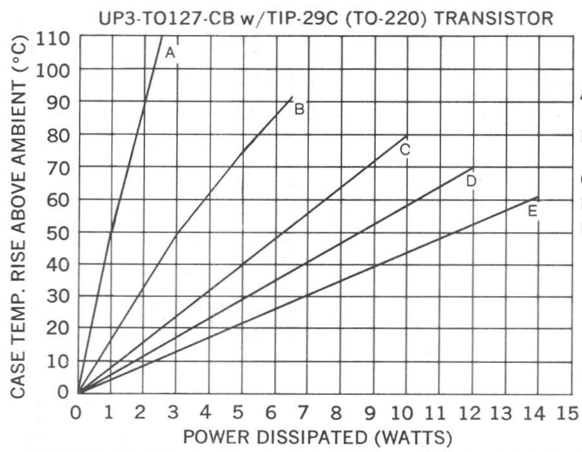
UP3 Single Mount Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.4 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

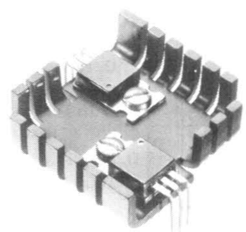
Ordering Information

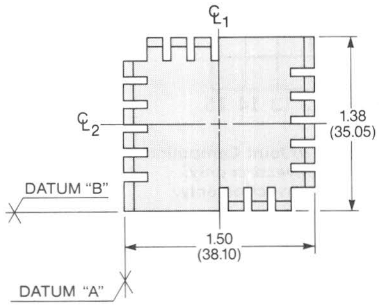
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP3-000-U	UP3-000-CB	UP3-000-B	UP3-000	Undrilled	—	10.5
UP3-TO126-U	UP3-TO126-CB	UP3-TO126-B	UP3-TO126	TO-126	5	10.5
UP3-TO127-U	UP3-TO127-CB	UP3-TO127-B	UP3-TO127	TO-127, TO-220	6	10.5
UP3-425-U	UP3-425-CB	UP3-425-B	UP3-425	Universal	7	10.5

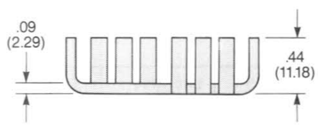
Note: See page iv for other finishes.

HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

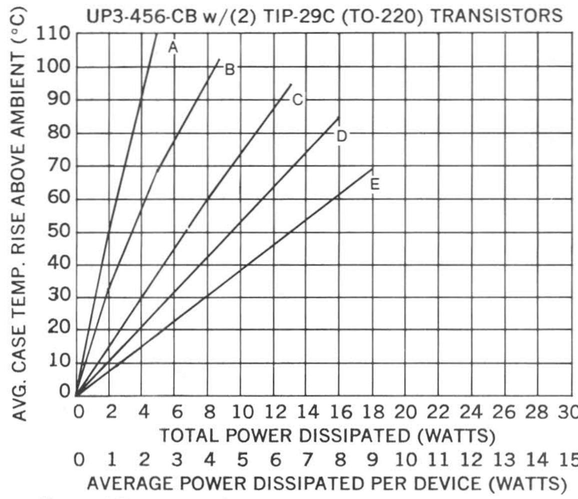
UP3 Dual Mount Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

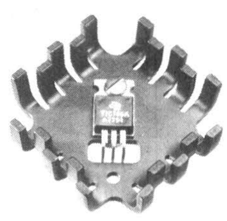
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.8 °C/watt per device for unplated part in natural convection only.
- Derate 3.0 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

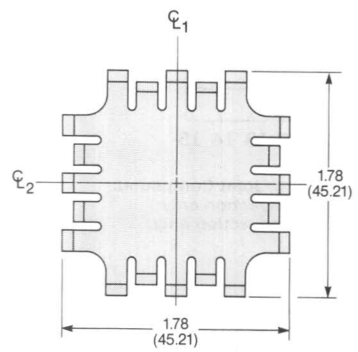
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP3-456-U	UP3-456-CB	UP3-456-B	UP3-456	Two TO-126s, Two TO-127s, Two TO-220s	8	10.5

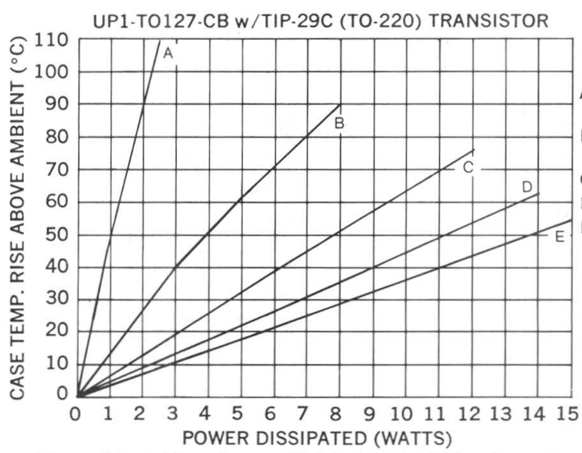
Note: See page iv for other finishes.

UP1 Single Mount Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

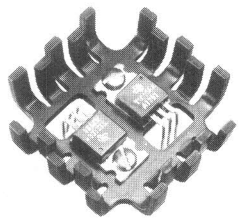
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

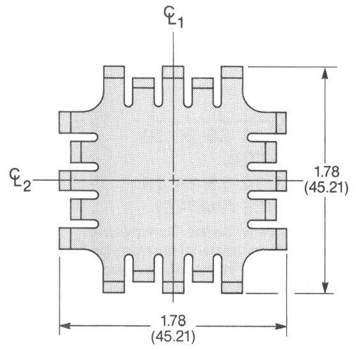
Ordering Information

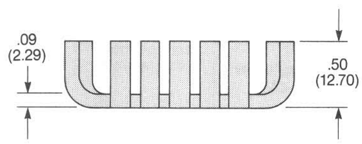
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP1-000-U	UP1-000-CB	UP1-000-B	UP1-000	Undrilled	—	15.5
UP1-TO126-U	UP1-TO126-CB	UP1-TO126-B	UP1-TO126	TO-126	5	15.5
UP1-TO127-U	UP1-TO127-CB	UP1-TO127-B	UP1-TO127	TO-127, TO-220	6	15.5
UP1-420-U	UP1-420-CB	UP1-420-B	UP1-420	Universal	9	15.5

Note: See page iv for other finishes.

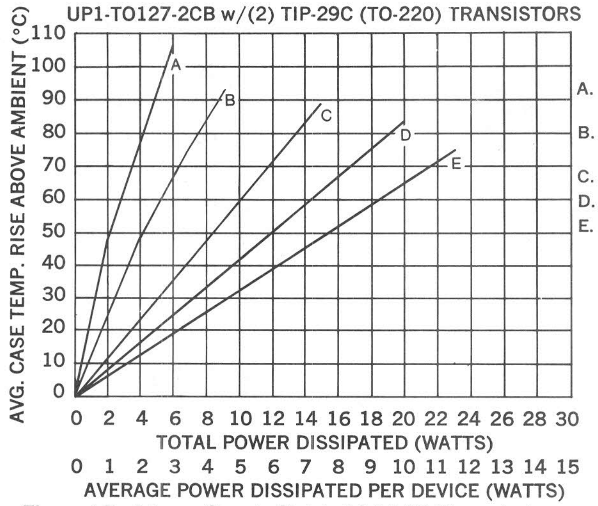
UP1 Dual Mount Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

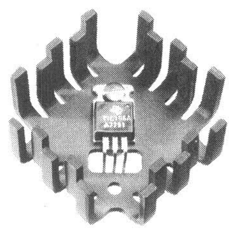
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W per device.
- Derate 1.4 °C/watt per device for unplated part in natural convection only.
- Derate 3.0 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

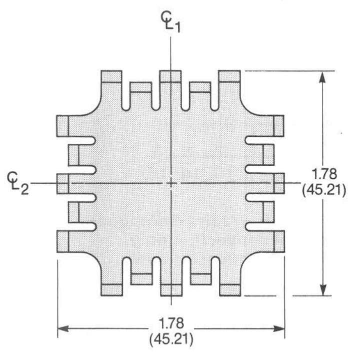
Ordering Information

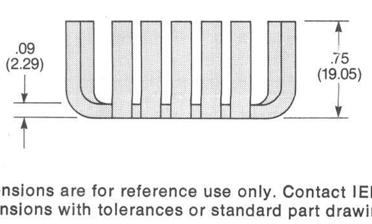
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP1-T0127-2U	UP1-T0127-2CB	UP1-T0127-2B	UP1-T0127-2	Two TO-127s, Two TO-220s	10	15.5

Note: See page iv for other finishes.

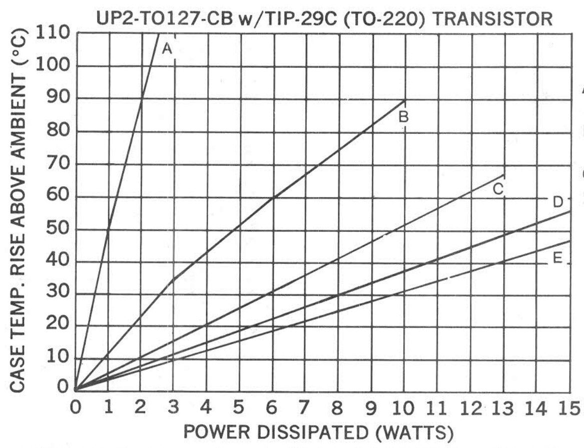
UP2 Single Mount Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

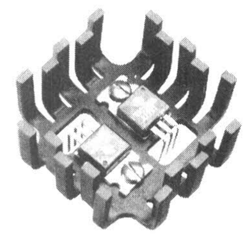
Ordering Information

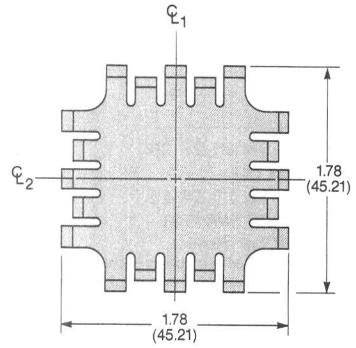
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP2-000-U	UP2-000-CB	UP2-000-B	UP2-000	Undrilled	—	19.1
UP2-T0126-U	UP2-T0126-CB	UP2-T0126-B	UP2-T0126	TO-126	5	19.1
UP2-T0127-U	UP2-T0127-CB	UP2-T0127-B	UP2-T0127	TO-127, TO-220	6	19.1
UP2-420-U	UP2-420-CB	UP2-420-B	UP2-420	Universal	9	19.1

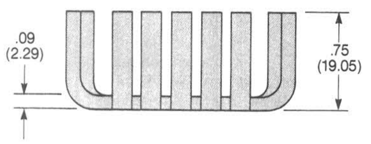
Note: See page iv for other finishes.

HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

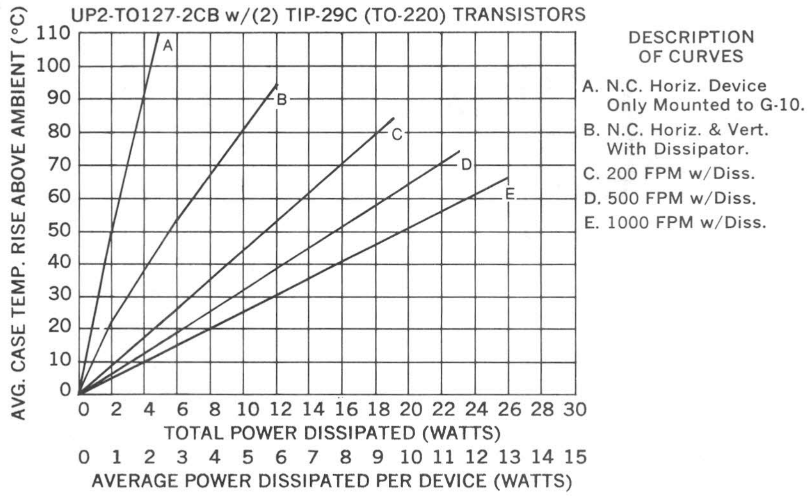
UP2 Dual Mount Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



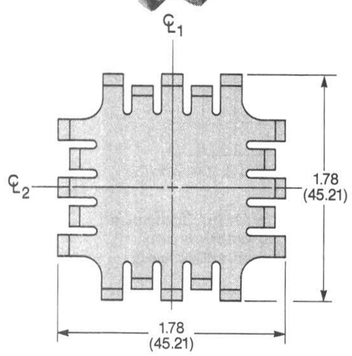
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 1.6 °C/watt per device for unplated part in natural convection only.
- Derate 3.0 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

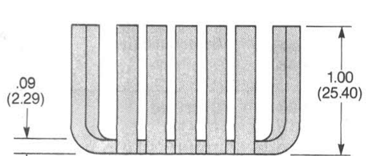
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP2-TO127-2U	UP2-TO127-2CB	UP2-TO127-2B	UP2-TO127-2	Two TO-127s, Two TO-220s	10	19.1

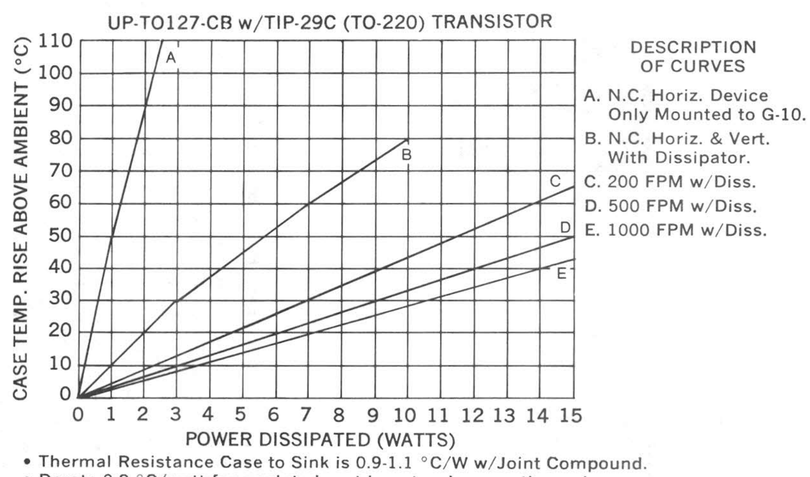
Note: See page iv for other finishes.

UP Single Mount Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



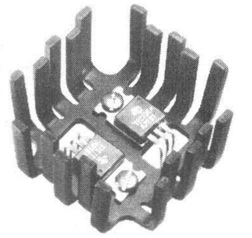
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

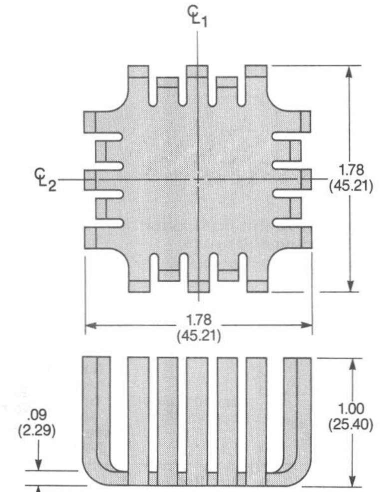
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP-000-U	UP-000-CB	UP-000-B	UP-000	Undrilled	—	22.5
UP-TO126-U	UP-TO126-CB	UP-TO126-B	UP-TO126	TO-126	5	22.5
UP-TO127-U	UP-TO127-CB	UP-TO127-B	UP-TO127	TO-127, TO-220	6	22.5
UP-420-U	UP-420-CB	UP-420-B	UP-420	Universal	9	22.5

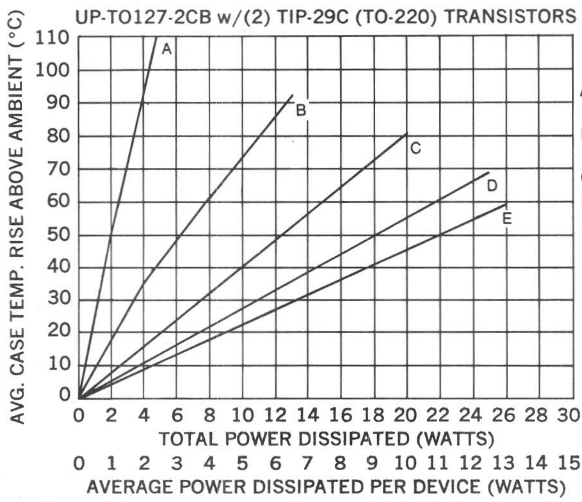
Note: See page iv for other finishes.

UP Dual Mount Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

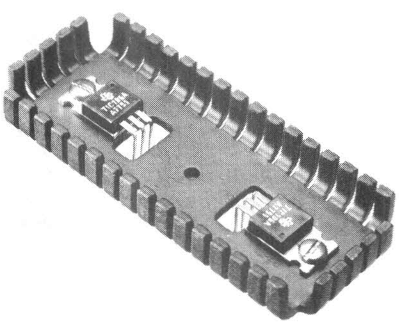
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 1.6 °C/watt per device for unplated part in natural convection only.
- Derate 3.0 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

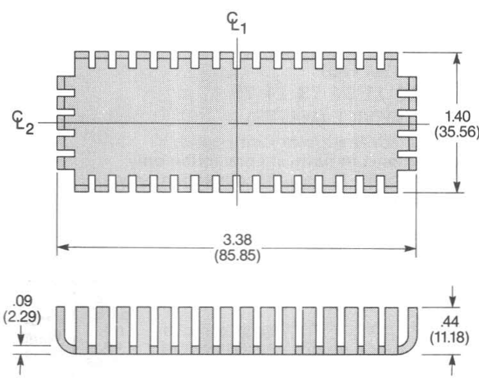
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP-TO127-2U	UP-TO127-2CB	UP-TO127-2B	UP-TO127-2	Two TO-127s, Two TO-220s	10	22.5

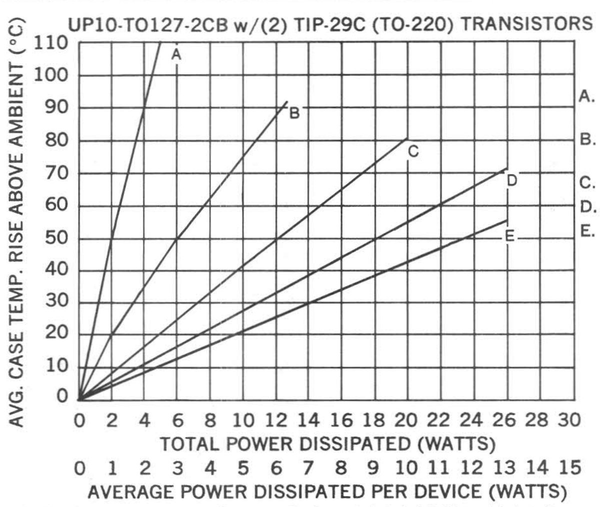
Note: See page iv for other finishes.

UP10 Dual Mount Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 0.8 °C/watt per device for unplated part in natural convection only.
- Derate 3.0 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

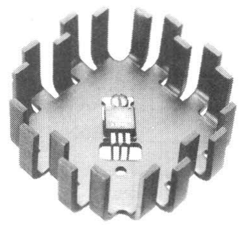
Ordering Information

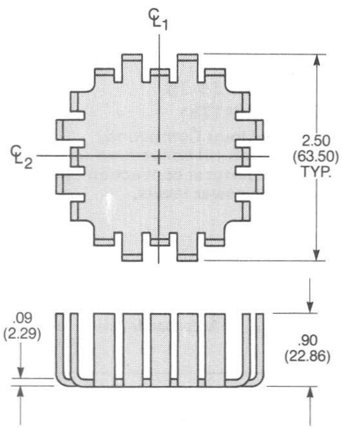
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
UP10-000-U	UP10-000-CB	UP10-000-B	UP10-000	Undrilled	—	24.0
UP10-TO127-2U	UP10-TO127-2CB	UP10-TO127-2B	UP10-TO127-2	Two TO-127s, Two TO-220s	11	24.0
UP10-426-2U	UP10-426-2CB	UP10-426-2B	UP10-426-2	Universal for 2 Transistors	12	24.0

Note: See page iv for other finishes.

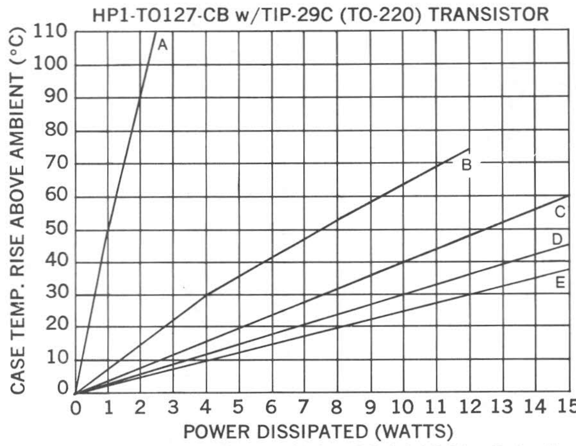
HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

HP1 Single Mount Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

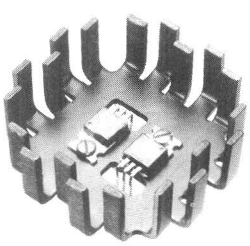
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

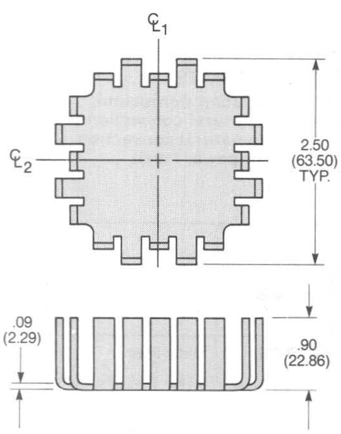
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP1-000-U	HP1-000-CB	HP1-000-B	HP1-000	Undrilled	—	35.0
HP1-TO126-U	HP1-TO126-CB	HP1-TO126-B	HP1-TO126	TO-126	5	35.0
HP1-TO127-U	HP1-TO127-CB	HP1-TO127-B	HP1-TO127	TO-127, TO-220	6	35.0
HP1-420-U	HP1-420-CB	HP1-420-B	HP1-420	Universal	9	35.0

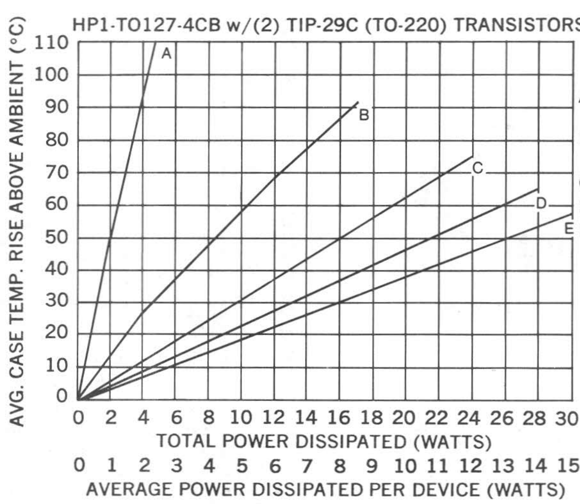
Note: See page iv for other finishes.

HP1 Dual Mount Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

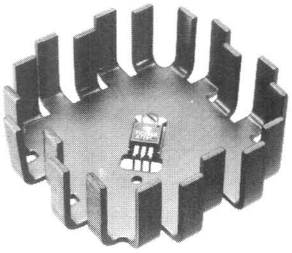
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 2.0 °C/watt per device for unplated part in natural convection only.
- Derate 3.0 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

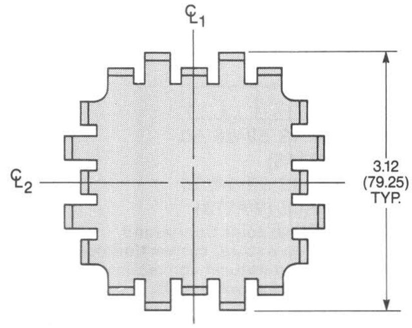
Ordering Information

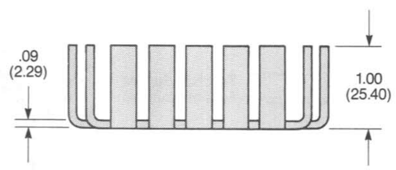
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP1-TO127-4U	HP1-TO127-4CB	HP1-TO127-4B	HP1-TO127-4	Two TO-127s, Two TO-220s	10	35.0

Note: See page iv for other finishes.

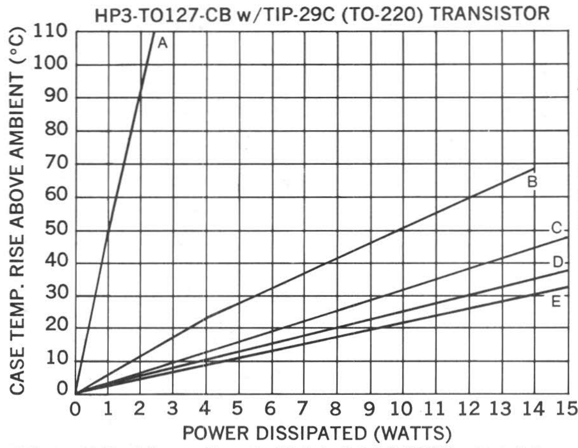
HP3 Single Mount Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

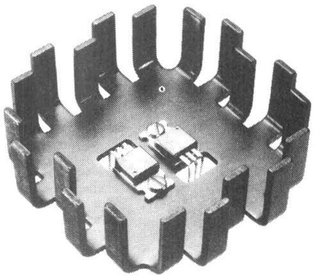
- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

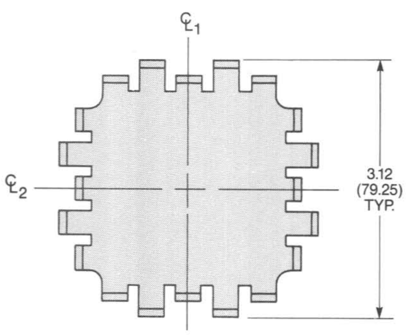
Ordering Information

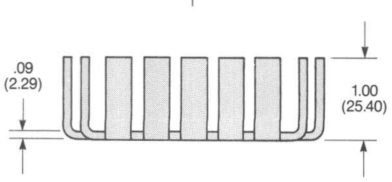
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-000-U	HP3-000-CB	HP3-000-B	HP3-000	Undrilled	—	55.0
HP3-TO126-U	HP3-TO126-CB	HP3-TO126-B	HP3-TO126	TO-126	5	55.0
HP3-TO127-U	HP3-TO127-CB	HP3-TO127-B	HP3-TO127	TO-127, TO-220	6	55.0
HP3-420-U	HP3-420-CB	HP3-420-B	HP3-420	Universal	9	55.0

Note: See page iv for other finishes.

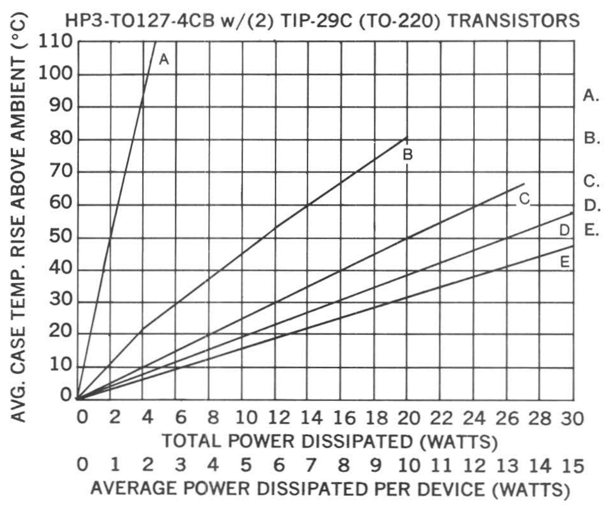
HP3 Dual Mount Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 2.0 °C/watt per device for unplated part in natural convection only.
- Derate 3.0 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

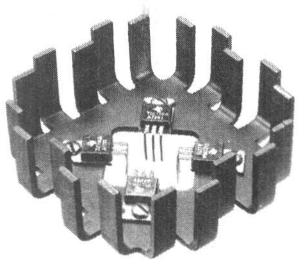
Ordering Information

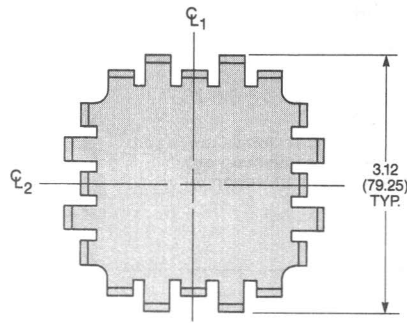
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-TO127-4U	HP3-TO127-4CB	HP3-TO127-4B	HP3-TO127-4	Two TO-127s, Two TO-220s	10	55.0

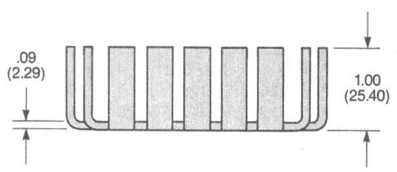
Note: See page iv for other finishes.

HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

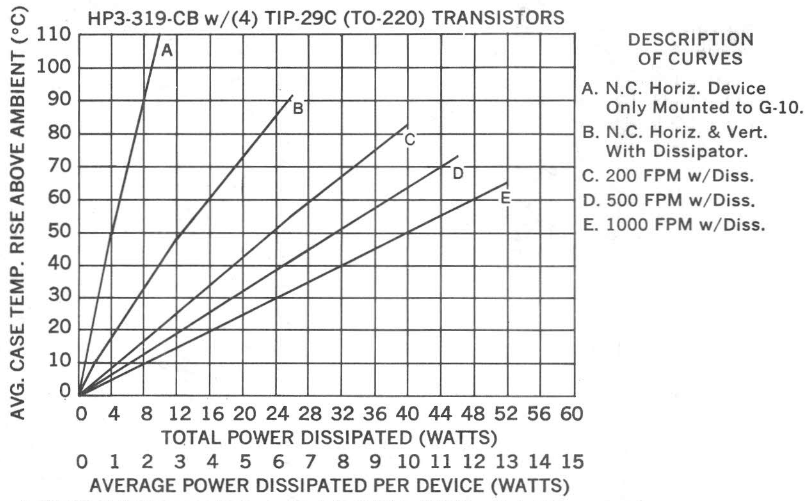
HP3 Quad Mount Series







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 0.9-1.1 °C/W w/Joint Compound.
- Derate 4.0 °C/watt per device for unplated part in natural convection only.
- Derate 3.0 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 6°C at equivalent power levels.

Ordering Information

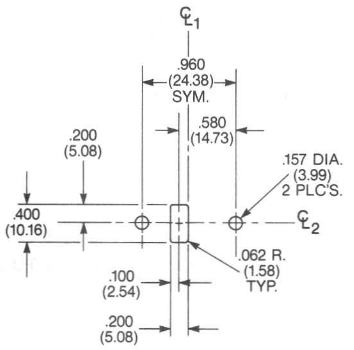
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 2-28)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube® 448			
HP3-319-U	HP3-319-CB	HP3-319-B	HP3-319	Four TO-126s, Four TO-127s, Four TO-220s	13	55.0

Note: See page iv for other finishes.

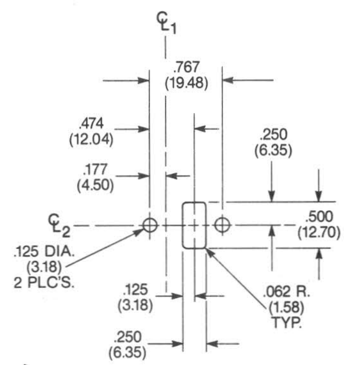
Standard hole patterns for plastic case heat dissipators

- Hole patterns shown here will accommodate virtually any plastic case power semiconductors.
- Hole patterns 4, 7, 9, and 12 are universal mounting hole patterns which simplify stocking and accommodate all plastic semiconductors with a flat mounting surface.
- Tooling is available for many hole patterns not shown here. Consult IERC if you do not see a hole pattern to meet your requirements.

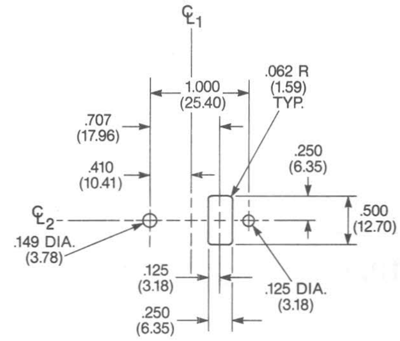
1. Hole pattern no. 252 accommodates TO-126s or TO-220s. Available in LA-A and LB series heat dissipators.



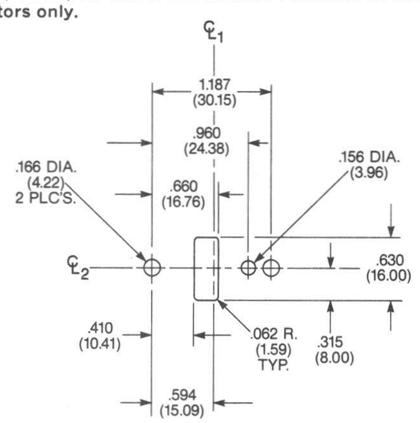
2. Hole pattern no. 365 accommodates TO-126s. Available in LA-B series heat dissipators only.



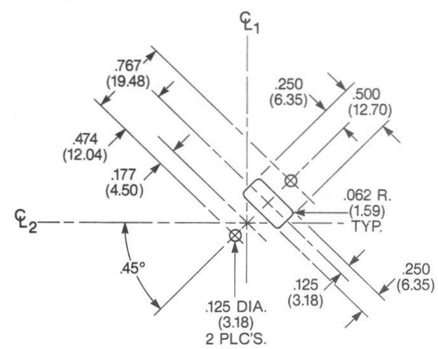
3. Hole pattern no. 268 accommodates TO-127s or TO-220s. Available in LA-B series heat dissipators only.



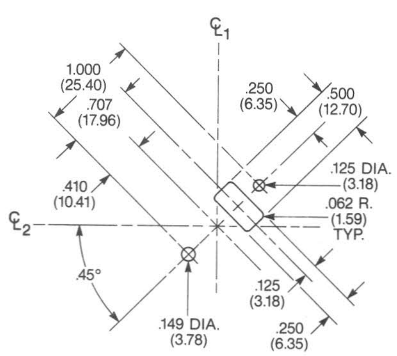
4. Hole pattern no. 394/universal accommodates TO-126s, TO-127s, TO-220s, TO-3s, TO-66s or B-3 outline. Available in LA-B series heat dissipators only.



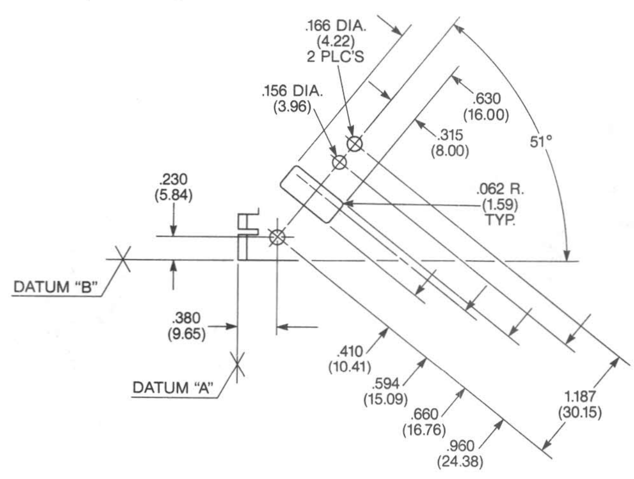
5. Hole pattern no. 215 accommodates TO-126s. Available in UP3, UP1, UP2, UP, HP1, and HP3 series heat dissipators.



6. Hole pattern no. 214 accommodates TO-127s or TO-220s. Available in UP1, UP2, UP, UP3, HP1, and HP3 series heat dissipators.

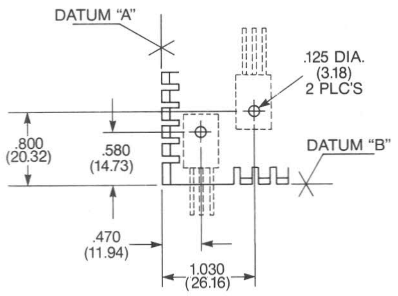


7. Hole pattern no. 425/universal accommodates TO-126s, TO-127s, TO-220s, TO-3s, TO-66s, or B-3 outline. Available in UP3 series heat dissipators only.

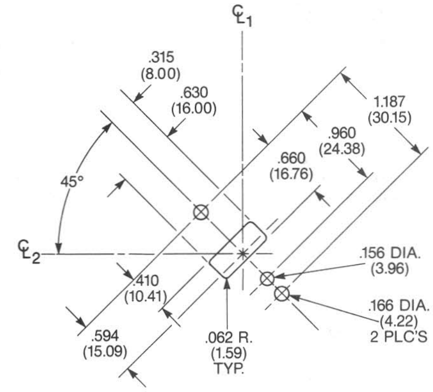


HEAT DISSIPATORS FOR PLASTIC CASE, CASE-MOUNTED SEMICONDUCTORS

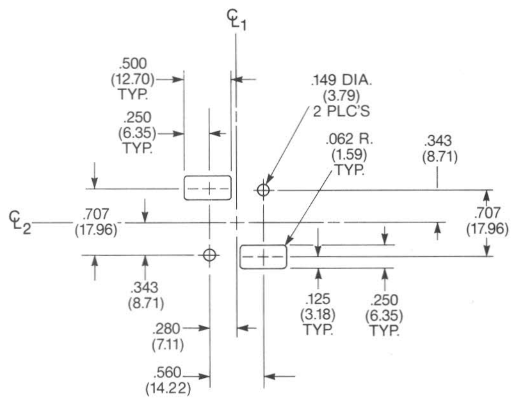
8. Hole pattern no. 456 accommodates two TO-126s, two TO-127s, or two TO-220s. Available in UP3 series heat dissipators only.



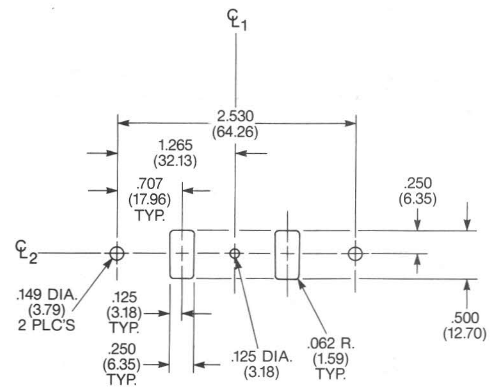
9. Hole pattern no. 420/universal accommodates TO-126s, TO-127s, TO-220s, TO-3s, TO-66s, or B-3 outline. Available in UP1, UP2, UP, HP1, and HP3 series heat dissipators.



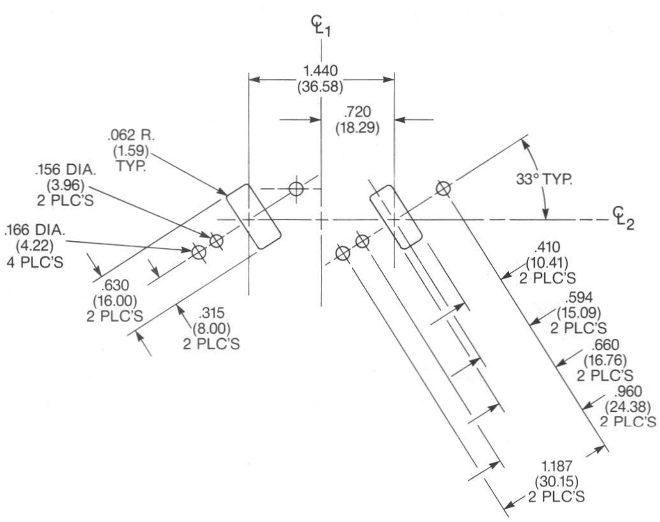
10. Hole pattern no. 259 accommodates two TO-127s or two TO-220s. Available in UP1, UP2, UP, HP1, and HP3 series heat dissipators.



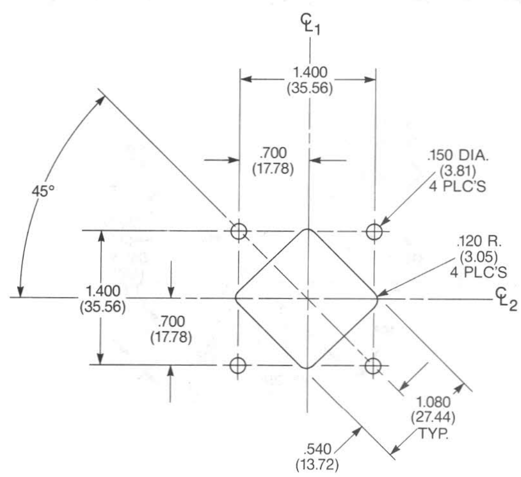
11. Hole pattern no. 258 accommodates two TO-127s or two TO-220s. Available in UP10 series heat dissipators only.



12. Hole pattern no. 426/universal accommodates two TO-126s, two TO-127s, two TO-220s, two TO-3s, two TO-66s, or two B-3 outlines. Available in UP10 series heat dissipators only.



13. Hole pattern no. 319 accommodates four TO-126s, four TO-127s, or four TO-220s. Available in HP3 series heat dissipators only.



SECTION 3

HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

below.

The index on the left is arranged according to increasing power dissipation capability (decreasing thermal resistance), while the index on the right lists dissipators in order of board area requirements and dissipator height.

Using the indices, it becomes a simple matter to locate a number of dissipators with similar, desirable thermal specifications; or to compare respective dimensions to determine the specific dissipator suited to your particular packaging requirements.

All thermal resistance data contained in these indices (unless otherwise noted) is based on 75°C case temperature rise above ambient indices are given for reference only. They are intended to help the engineer "zero in" on a suitable dissipator and should not be used to predict actual thermal performance.

The IERC dissipators illustrated in this section can solve a wide variety of thermal management problems, when they are chosen carefully. Features and detailed descriptions of the individual dissipators are located in the appropriate areas within the section.

In order to select the proper heat dissipator for a particular application, simply follow the formula outlined below to determine the correct part number.

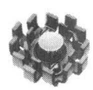
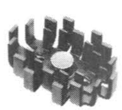
1. Determine maximum anticipated power dissipation.

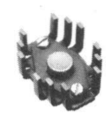
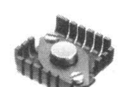
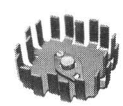
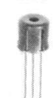
The maximum allowable case temperature may be determined by obtaining the maximum operating junction temperature and the thermal resistance from junction to case (θ_{jc}) from the semiconductor manufacturer's data sheet. The maximum case temperature is the maximum junction temperature minus the product of the thermal resistance junction-to-case and the maximum power dissipation anticipated.

$$T_c = T_j - \theta_{j\text{-}c} P_{diss}$$

It is frequent practice to hold the case temperature to less than the maximum allowable temperature in order to increase component reliability. For a more

INDEX BY THERMAL RESISTANCE

Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Mounting Envelope LxWxH (inches)	Page
Fan Tops	**TO-18**				
	TXBF	150.0	45.1	.50 Dia. x .25	3-4
	TO-5				
	TXBF	81.1	27.8	.75 Dia. x .25	3-4
	TXCF	63.6	22.7	1.25 Dia. x .12	3-5
	TXBF2	56.6	25.6	1.25 Dia. x .36	3-5
	**TO-8**				
	TXBF2	41.7	15.9	1.25 Dia. x .33	3-6
	TXCF	40.5	14.7	1.25 Dia. x .12	3-6
Board-Mounted	**TO-18**				
	LP18[1]	32.5	10.5	1.06 x 1.06 x .50	3-10
	**TO-5**				
	LP—A2	24.2	5.0	1.06 x 1.06 x .31	3-12
	LP—A1	23.1	4.2	1.06 x 1.06 x .50	3-11
	LP—B4[5]	20.6	4.2	1.66 x 1.12 x .31	3-16
	LP—B2	19.7	4.3	1.66 x 1.12 x .31	3-14
	LP—B1	16.1	3.7	1.66 x 1.12 x .50	3-13
	LP—B3[5]	15.3	3.0	1.66 x 1.12 x .50	3-15
	LP—C2	15.3	2.8	2.31 x 1.12 x .31	3-18
	LP—C4[5]	15.0	3.6	2.31 x 1.12 x .31	3-20
	LP—C1	12.6	2.2	2.31 x 1.12 x .50	3-17
	LP—C3[5]	12.0	2.9	2.31 x 1.12 x .50	3-19

Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Mounting Envelope LxWxH (inches)	Page
Board-Mounted (cont.)	**TO-8**				
	LAIC8B7	17.4	6.8	1.63 x 1.29 x .40	3-21
	LAIC8B2	16.3	6.3	1.63 x 1.29 x .50	3-21
	UP3-TO8	16.3	5.4	1.50 x 1.38 x .44	3-23
	LAIC8B3	14.3	5.7	1.63 x 1.29 x .75	3-22
	LAIC8B4	12.7	5.2	1.63 x 1.29 x 1.00	3-22
	UP1-TO8	12.5	4.6	1.78 x 1.78 x .50	3-24
	LAIC8B5	11.7	5.0	1.63 x 1.29 x 1.25	3-23
	UP2-TO8	10.4	3.9	1.78 x 1.78 x .75	3-24
	UP-TO8	9.0	3.9	1.78 x 1.78 x 1.00	3-25
	HP1-TO8[2]	7.0	3.4	2.50 x 2.50 x .90	3-25
	HP3-TO8[2]	5.9	3.1	3.13 x 3.13 x 1.00	3-26
Thermal Links	**TX Series**				
	**TO-18**	150.26[3] 14.29[4]	N/A		3-7
	TO-5	73.17[3] 11.43[4]	N/A	See outline drawings for dimensions.	3-8
	**TO-8**	41.67[3] 4.94[4]	N/A		3-9

Notes: [1] Thermal resistances based on performance at 35°C case rise above ambient in natural convection and 10°C case rise above ambient in forced air (1000 fpm).
[2] Thermal resistances based on 60°C case rise in natural convection and 30°C case rise in forced air (1000 fpm).
[3] Thermal link mounted to G-10 circuit board.
[4] Thermal link mounted to infinite heat sink.
[5] Dissipator accommodates two transistors. Thermal resistance figures based on average temperature rise divided by total power dissipated.

detailed explanation, see "Principles of Thermal Management" in this catalog.

3. Determine allowable thermal resistance from case-to-ambient by dividing allowable temperature rise by the maximum power dissipation (°C/W).
4. Determine desired mounting orientation, either free standing or horizontal (board) mount.
5. Determine whether you wish to mount two or more semiconductors on one sink for thermal matching and space utilization. One dissipator for two semiconductors often uses less space than two heat sinks.
6. Will the dissipator be used in natural convection or forced air — if so, at what velocity? Dissipator efficiency can be greatly increased when forced air is used (See index, this page).
7. Select a dissipator from the thermal resistance table below and turn to page indicated. From the graph of case temperature rise above ambient determine actual case temperature for given power dissipation. You will note that heat dissipator thermal resistance can vary with power level and dissipator temperature. Is this temperature rise acceptable? If not, consult the Thermal Resistance Index to find a dissipator with a slightly lower thermal resistance. If you must maintain a specific board area requirement select a more effective, i.e., taller dissipator from the Index by Board Area and then make your final selection based upon the performance curves supplied for each part in the catalog.
8. From the ordering information select the hole pattern (if applicable) and finish desired. Note that an unplated part will run hotter than a black anodized part in natural convection by the amount given in the rating factors.

Other factors regarding dissipator efficiency and selection parameters are covered in "Principles of Thermal Management."

The following example illustrates this simple procedure.

Problem: To cool a TO-5 case transistor that will dissipate 1.0 watts. From the transistor data sheet we determine that:

T_j max. $= 170°C$ and
$\theta_{j\text{-}c} = 35.7\ °C/W$

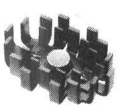
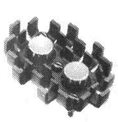
$$\text{Max. Case Temp.} = 170 - (35.7)\ (1) = 134.3°C$$

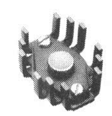
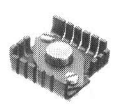
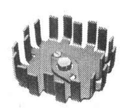
For increased reliability and a safety factor, we set the design case temperature at 100°C. A design ambient of 72°C is set. Therefore, max. allowable temperature rise is 28°C. This makes the max. allowable thermal resistance

$$\frac{28°C}{1.0W} = 28°C/W.$$

No forced air is available so the design must be for natural convection. Looking down the index shows we cannot use a free-standing Fan Top dissipator. (Note that if 1000 fpm of forced air were available a standard Fan Top dissipator would be adequate.) In the board-mounted section of the Index by Thermal Resistance we see that the LP-A2 has a slightly lower thermal resistance than the calculated maximum, and therefore looks like a good candidate. From the thermal performance curve on page 3-12, the case rise above ambient is found to be 27°C at a power level of 1 watt. Adding this to our design ambient of 72°C yields a maximum case temperature of 99°C or 1°C below our design maximum.

INDEX BY BOARD AREA REQUIREMENTS

Heat Dissipator Configuration	Part Series	Mounting Envelope LxWxH (inches)	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page
Fan Tops	**TO-18**				
	TXBF	.50 Dia. x .25	150.0	45.1	3-4
	TO-5				
	TXBF	.75 Dia. x .25	81.1	27.8	3-4
	TXCF	1.25 Dia. x .12	63.6	22.7	3-5
	TXBF2	1.25 Dia. x .36	40.5	14.7	3-5
	TO-8				
	TXCF	1.25 Dia. x .12	56.6	25.6	3-6
	TXBF2	1.25 Dia. x .33	41.7	15.9	3-6
Board-Mounted	**TO-18**				
	LP18[1]	1.06 x 1.06 x .50	32.5	10.5	3-10
	**TO-5**				
	LP—A2	1.06 x 1.06 x .31	24.2	5.0	3-12
	LP—A1	1.06 x 1.06 x .50	23.1	4.2	3-11
	LP—B2	1.66 x 1.12 x .31	19.7	4.3	3-14
	LP—B1	1.66 x 1.12 x .50	16.1	3.7	3-13
	LP—B4[5]	1.66 x 1.12 x .31	20.6	4.2	3-16
	LP—B3[5]	1.66 x 1.12 x .50	15.3	3.0	3-15
	LP—C2	2.31 x 1.12 x .31	15.3	2.8	3-18
	LP—C1	2.31 x 1.12 x .50	12.6	2.2	3-17
	LP—C4[5]	2.31 x 1.12 x .31	15.0	3.6	3-20
	LP—C3[5]	2.31 x 1.12 x .50	12.0	2.9	3-19

Heat Dissipator Configuration	Part Series	Mounting Envelope LxWxH (inches)	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page
Board-Mounted (cont.)	**TO-8**				
	UP3-TO8	1.50 x 1.38 x .44	16.3	5.4	3-23
	LAIC8B7	1.63 x 1.29 x .40	17.4	6.8	3-21
	LAIC8B2	1.63 x 1.29 x .50	16.3	6.3	3-21
	LAIC8B3	1.63 x 1.29 x .75	14.3	5.7	3-22
	LAIC8B4	1.63 x 1.29 x 1.00	12.7	5.2	3-22
	LAIC8B5	1.63 x 1.29 x 1.25	11.7	5.0	3-23
	UP1-TO8	1.78 x 1.78 x .50	12.5	4.6	3-24
	UP2-TO8	1.78 x 1.78 x .75	10.4	3.9	3-24
	UP-TO8	1.78 x 1.78 x 1.00	9.0	3.9	3-25
	HP1-TO8[2]	2.50 x 2.50 x .90	7.0	3.4	3-25
	HP3-TO8[2]	3.13 x 3.13 x 1.00	5.9	3.1	3-26
Thermal Links	**TX Series**				
	**TO-18**	See outline drawings for dimensions.	41.7[3] 4.9[4]	N/A	3-7
	TO-5		73.2[3] 11.4[4]	N/A	3-8
	**TO-8**		105.3[3] 14.3[4]	N/A	3-9

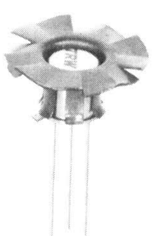
Notes: [1] Thermal resistances based on performance at 35°C case rise above ambient in natural convection and 10°C case rise above ambient in forced air (1000 fpm).
[2] Thermal resistances based on 60°C case rise in natural convection and 30°C case rise in forced air (1000 fpm).
[3] Thermal link mounted to G-10 circuit board.
[4] Thermal link mounted to infinite heat sink.
[5] Dissipator accommodates two transistors. Thermal resistance figures based on average temperature rise divided by total power dissipated.

HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

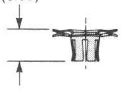
Low-cost, press-on heat dissipators

- Fan top blade design maximizes radiation and convection efficiency in both natural convection and forced-air modes.
- Requires virtually no board area.
- Easy press-on installation — no special tools or hardware required.
- Performance level of transistors is increased, giving the circuit designer greater latitude for power dissipation and board layout.
- Spring finger design gives a smooth, consistent press-fit over the entire range of JEDEC specified case diameters; dissipator can be installed and removed multiple times without affecting press-fit or performance.
- Fan tops are made of beryllium copper or brass.

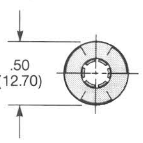
Fan Tops for TO-18s



.25
(6.35)

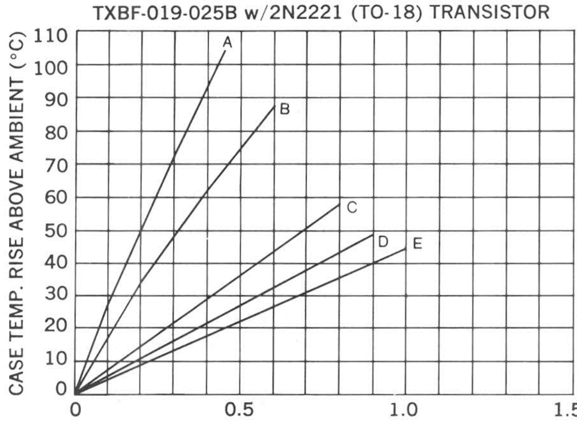


.50
(12.70)



Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

TXBF-019-025B w/2N2221 (TO-18) TRANSISTOR



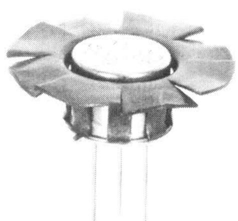
DESCRIPTION OF CURVES
A. N.C. Horiz. Device w/Transipad on G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Test Conducted Without Thermal Joint Compound.
- Derate 3.3 °C/watt for unplated part in natural convection only.

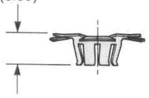
Ordering Information

IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Cadmium	Black Chemical			
TXBF-019-025U	TXBF-019-025B	N/A	One TO-18	Be Cu	0.5
TXCF-019-025U	N/A	TXCF-019-025CB	One TO-18	Brass	0.5

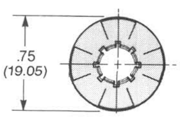
Fan Tops for TO-5s



.25
(6.35)

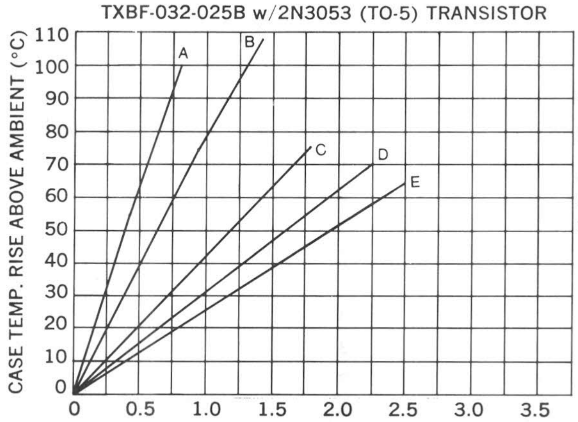


.75
(19.05)



Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

TXBF-032-025B w/2N3053 (TO-5) TRANSISTOR



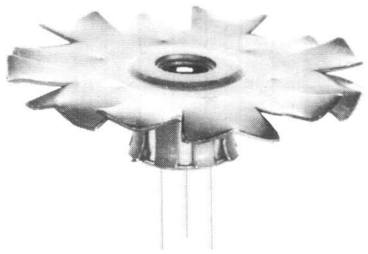
DESCRIPTION OF CURVES
A. N.C. Horiz. Device w/Transipad on G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

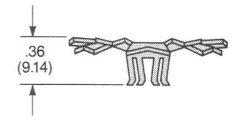
- Test Conducted Without Thermal Joint Compound.
- Derate 5.0 °C/watt for unplated part in natural convection only.

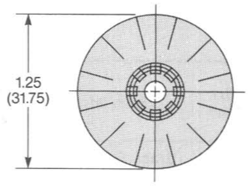
Ordering Information

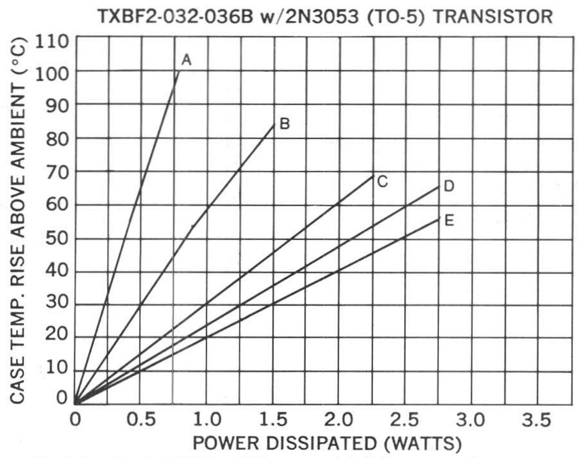
IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Cadmium	Black Chemical			
TXBF-032-025U	TXBF-032-025B	N/A	One TO-5	Be Cu	1.2
TXCF-032-025U	N/A	TXCF-032-025CB	One TO-5	Brass	1.2

Super Fan Tops for TO-5s









DESCRIPTION OF CURVES

A. N.C. Horiz. Device w/Transipad on G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

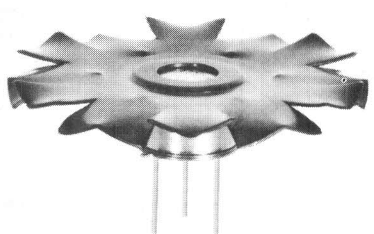
- Test Conducted Without Thermal Joint Compound.
- Derate 6.2 °C/watt for unplated part in natural convection only.

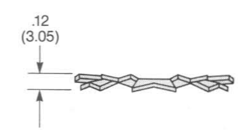
Ordering Information

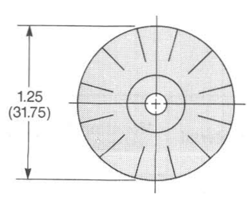
IERC PART NO.		Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Cadmium			
TXBF2-032-036U	TXBF2-032-036B	One TO-5	Brass Fan, Be Cu Retainer	4.0

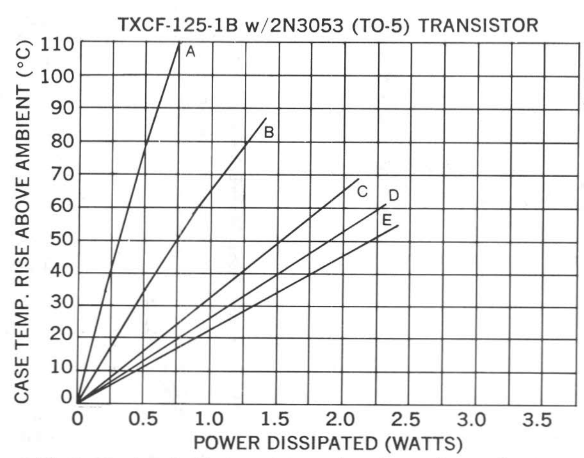
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Fan Blade for TO-5s









DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Dissipator bonded to transistor using thermally conductive epoxy.
- Derate 5.0 °C/watt for unplated part in naturai convection only.

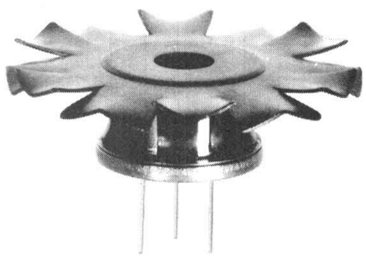
Ordering Information

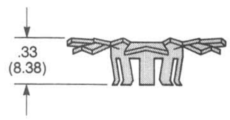
IERC PART NO.		Semiconductor Accommodated	Material	Mounting Method	Max. Weight (Grams)
Unplated	Black Cadmium				
TXCF-125-1U	TXCF-125-1B	One TO-5	Brass	Epoxy	3.0

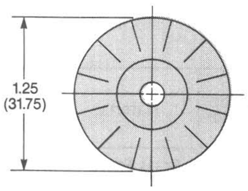
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

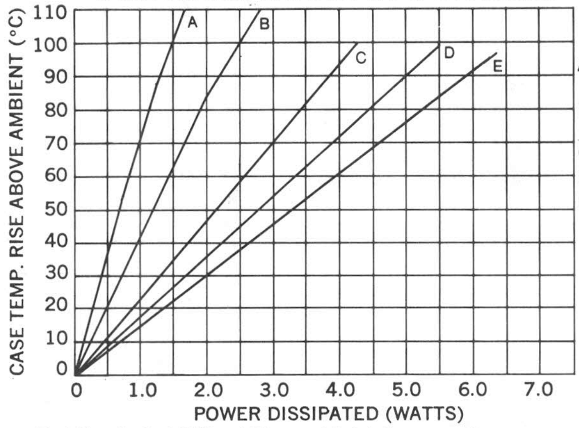
Fan Tops for TO-8s







TXBF2-050-033B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

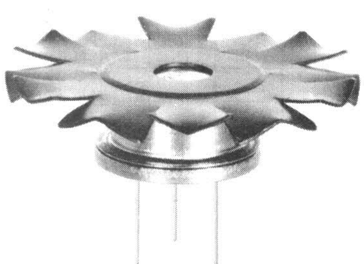
- Test Conducted Without Thermal Joint Compound.
- Derate 6.2 °C/watt for unplated part in natural convection only.

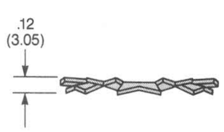
Ordering Information

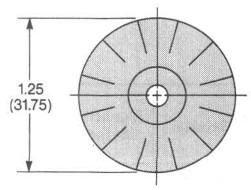
IERC PART NO.		Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Cadmium			
TXBF2-050-033U	TXBF2-050-033B	One TO-8	Brass Fan, Be Cu Retainer	4.2

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

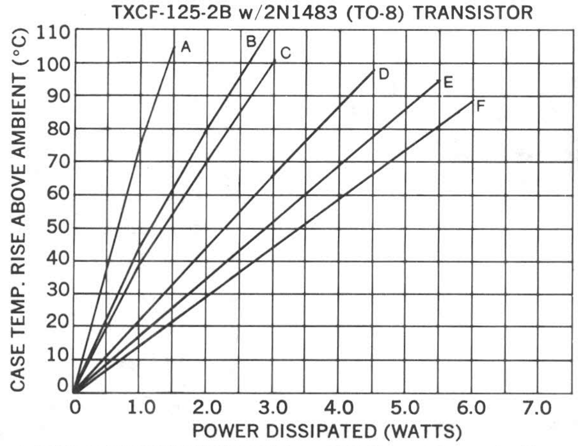
Fan Blade for TO-8s







TXCF-125-2B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device w/Transipad on G-10.
B. N.C. Horiz. w/Diss.
C. N.C. Vert. w/Diss.
D. 200 FPM w/Diss.
E. 500 FPM w/Diss.
F. 1000 FPM w/Diss.

- Dissipator bonded to transistor using thermally conductive epoxy.
- Derate 4.5 °C/watt for unplated part in natural convection only.

Ordering Information

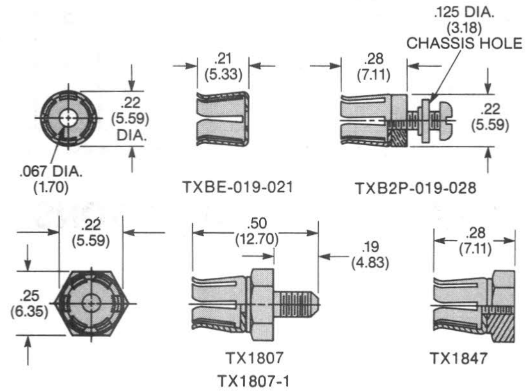
IERC PART NO.		Semiconductor Accommodated	Material	Mounting Method	Max. Weight (Grams)
Unplated	Black Cadmium				
TXCF-125-2U	TXCF-125-2B	One TO-8	Brass	Epoxy	3.0

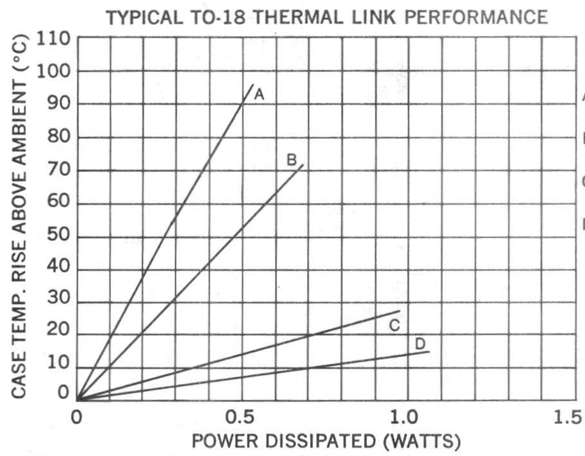
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Thermal link heat dissipators

- Provides an effective retainer and efficient thermal path between semiconductor and heat sinks or chassis.
- Multiple fingers permit a smooth press-fit installation without harmful "snap" action.
- Excellent transistor retention — will retain transistors in environment of 100 to 2000 cps at 20g per MIL-STD-750, method 2056, withstanding shock per MIL-STD-750, method 2016 up to 1500g.
- Can be inserted and removed multiple times without loss of retention or damage to the finish over the entire JEDEC case diameter range.
- Thermal links can be installed with a rivet or eyelet, soldered to a printed circuit pad or heat sink, mounted with a single screw, or with a threaded stud and hex nut.
- BeCu retainer, brass fittings.

Thermal Links for TO-18s





DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. w/Diss. on Epoxy Board.
C. N.C. Horiz. w/Diss. on Alum. Board.
D. N.C. Horiz. w/Diss. on Const. Temp. Sink.

- Thermal Joint Compound used at all interfaces.
- Derate 9.2 °C/watt for Insulube® part.

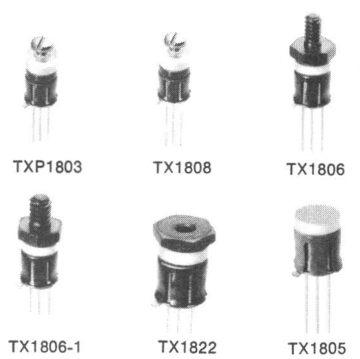
Ordering Information

IERC PART NO.			Mounting Method	Max. Weight (Grams)
Black Cadmium	Insulube 448®	Nickel		
TXBE-019-021B	TXBE-019-021	TXBE-019-021ND	Solder, epoxy, rivet	.5
TXB2P-019-028B	TXB2P-019-028	TXB2P-019-028ND	2-56 screw*	1.0
TX1807B	TX1807	TX1807ND	4-40 stud	1.2
TX1807-1B	TX1807-1	TX1807-1ND	6-32 stud	1.3
TX1847B	TX1847	TX1847ND	2-56 x 1/4 nut	.8

*Screw and shouldered nylon washer for .060 chassis included. If mounting hardware not desired delete "P" from part number. Note: See page iv for other finishes.

Thermal Links with BeO Washer for TO-18s

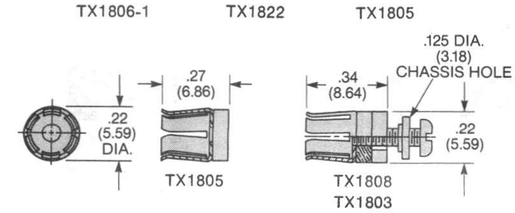
Provides 1000 VDC electrical isolation. Reduces transistor-chassis capacitance to 1.4-2.5 pf.

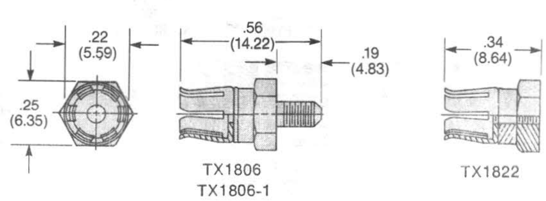


Ordering Information

IERC PART NO.		Mounting Method	Max. Weight (Grams)
Nickel	Black Cadmium		
TXP1803ND	TXP1803B*	2-56 screw***	1.0
TXP1808ND	TXP1808B**	2-56 screw***	1.0
TX1806ND	TX1806B	4-40 stud	1.3
TX1806-1ND	TX1806-1B	6-32 stud	1.4
TX1822ND	TX1822B	2-56 x 1/4 nut	1.0
TX1805ND	N/A	Solder or epoxy	.8

*BeO washer separate.
**BeO washer brazed on.
***Screw and shouldered nylon washer for .060 chassis included. If mounting hardware not desired delete "P" from part number.
Note: See page iv for other finishes.



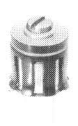


Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

Thermal Links for TO-5s

TXBE-032-031



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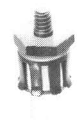
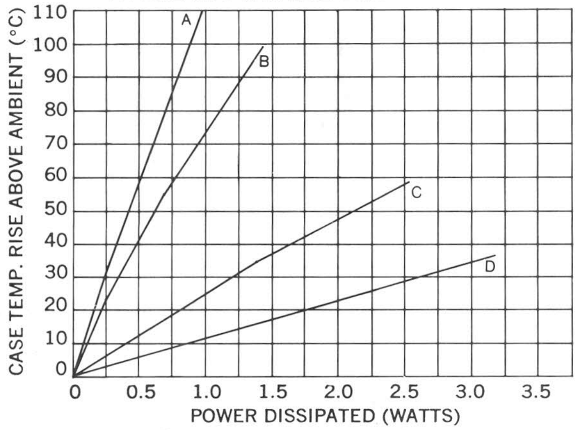


TX0507-1

TX0507-2

TX0547

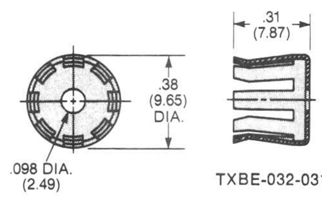
TYPICAL TO-5 THERMAL LINK PERFORMANCE



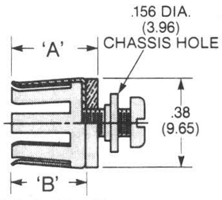
DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. w/Diss. on Epoxy Board.
C. N.C. Horiz. w/Diss. on Alum. Board.
D. N.C. Horiz. w/Diss. on Const. Temp. Sink.

- Thermal Joint Compound used at all interfaces.
- Derate 10.7 °C/watt for Insulube® part.



TXBE-032-031



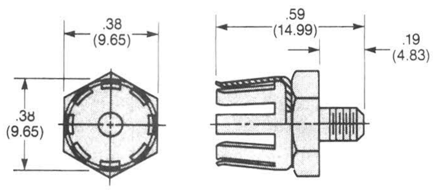
TXB2P-032-037
TXB2P-032-029
TXB2P-032-025

Ordering Information

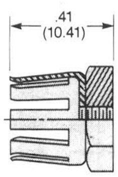
IERC PART NO.			Mounting Method	Max. Weight (Grams)	'A' DIM	'B' DIM
Black Cadmium	Insulube 448®	Nickel				
TXBE-032-031B	TXBE-032-031	TXBE-032-031ND	Solder, glue, rivet	1.0	—	—
TXB2P-032-037B	TXB2P-032-037	TXB2P-032-037ND	4-40 screw*	2.4	.37	.25
TXB2P-032-029B	TXB2P-032-029	TXB2P-032-029ND	4-40 screw*	2.0	.28	.22
TXB2P-032-025B	TXB2P-032-025	TXB2P-032-025ND	4-40 screw*	1.8	.25	.17
TX0507-1B	TX0507-1	TX0507-1ND	6-32 stud	3.0	—	—
TX0507-2B	TX0507-2	TX0507-2ND	10-32 stud	3.3	—	—
TX0547B	TX0547	TX0547ND	4-40 x ⅜ nut	2.8	—	—

*Screw and shouldered nylon washer for .060 chassis included. If mounting hardware not desired delete "P" from part number.
Note: See page iv for other finishes.

CALL FOR SPECIAL CONFIGURATIONS



TX0507-1
TX0507-2



TX0547

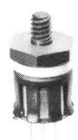
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Thermal Links with BeO Washer for TO-5s

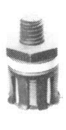
Provides 1000 VDC electrical isolation. Reduces transistor-chassis capacitance to 4.2-5.5 pf.

TXP0503

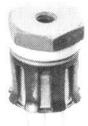
TXP0508



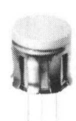
TX0506-1



TX0506-2



TX0522

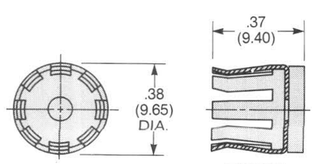


TX0505

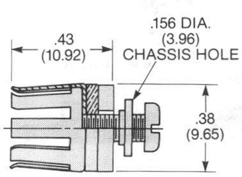
Ordering Information

IERC PART NO.		Mounting Method	Max. Weight (Grams)
Nickel	Black Cadmium		
TXP0503ND	TXP0503B*	4-40 screw***	2.5
TXP0508ND	TXP0508B**	4-40 screw***	2.5
TX0506-1ND	TX0506-1B	6-32 stud	3.2
TX0506-2ND	TX0506-2B	10-32 stud	3.5
TX0522ND	TX0522B	4-40 x ⅜ nut	3.0
TX0505ND	N/A	Solder or epoxy	1.5

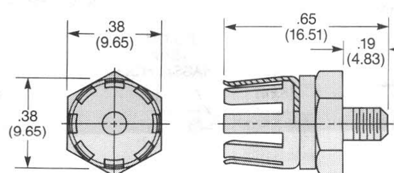
*BeO washer separate.
**BeO washer brazed on.
***Screw and shouldered nylon washer for .060 chassis included. If mounting hardware not desired delete "P" from part number.
Note: See page iv for other finishes.



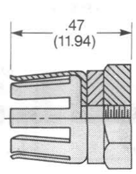
TX0505



TXP0508
TXP0503



TX0506-1
TX0506-2



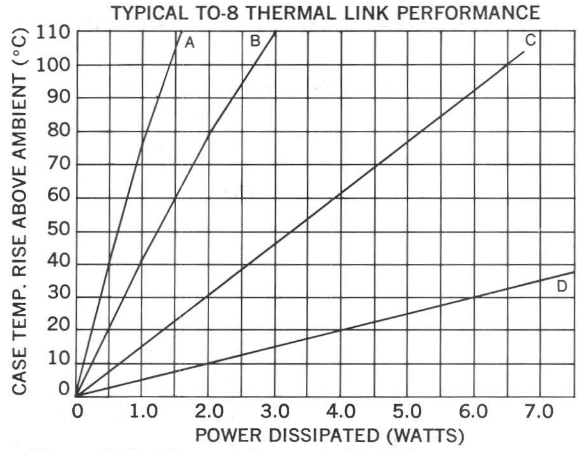
TX0522

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Thermal Links for TO-8s

TXBE-050-028

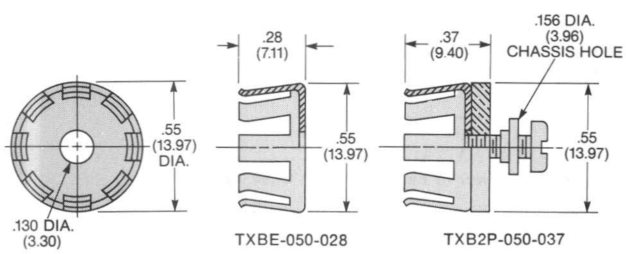
TXB2P-050-037



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. w/Diss. on Epoxy Board.
C. N.C. Horiz. w/Diss. on Alum. Board.
D. N.C. Horiz. w/Diss. on Const. Temp. Sink.

- Thermal Joint Compound used at all interfaces.
- Derate 10.0 °C/watt for Insulube® part.



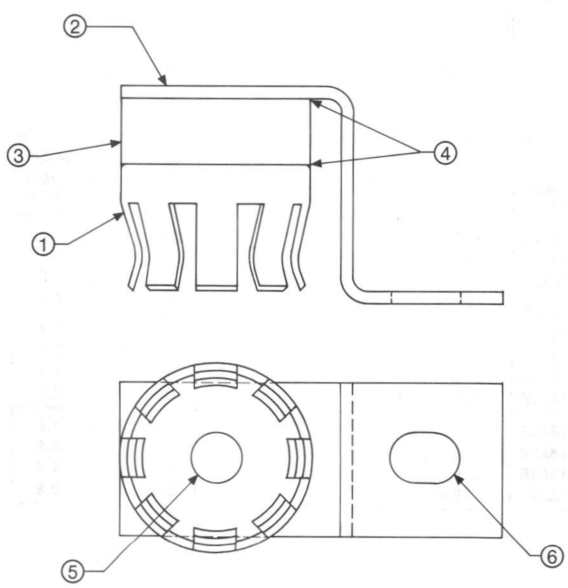
TXBE-050-028 TXB2P-050-037

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

IERC Part Number			Mounting Method	Max Weight (Grams)	Case Dia.
Black Cadmium	Insulube 448	Nickel			
TXBE-045-028B	TXBE-045-028	TXBE-045-028ND	Solder, Epoxy, Rivet	1.5	0.455
TXB2P-045-037B	TXB2P-045-037	TXB2P-045-037ND	4-40 Screw	4.5	0.455
TXBE-050-028B	TXBE-050-028	TXBE-050-028 ND	Solder, Epoxy, Rivet	1.5	0.500
TXB2P-050-037B	TXB2P-050-037	TXB2P-050-037ND	4-40 Screw	4.5	0.500
TXBE-055-028B	TXBE-055-028	TXBE-055-028 ND	Solder, Epoxy, Rivet	1.5	0.550
TXB2P-055-037B	TXB2P-055-037	TXB2P-055-037ND	4-40 Screw	4.5	0.550

*Screw and shouldered nylon washer for .060 chassis included. If mounting hardware not desired delete "P" from part number. Note: See page iv for other finishes.



SPECIALS
(CALL FOR ASSISTANCE)

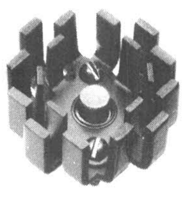
1. Select appropriate thermal link.
2. Select bracket material and thickness and width.
3. Spacers can be BeO, Aluminum Nitride, Brass or Combinations.
4. Select braze or bonded assembly method.
5. Optional hole pattern—can be threaded or thru hole or blank.
6. Mounting hole pattern.

HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

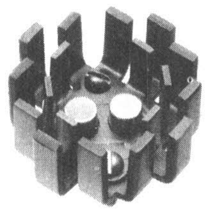
Heat dissipators/retainers for low- and medium-power semiconductors

- Compact design requires little board area for single- or dual-mounted transistors.
- Dual-mounted dissipators thermally balance transistors, assuring matched electrical characteristics.
- Clamp sections can be used separately as low-power dissipator/retainers.
- Low thermal resistance from transistor to dissipator is achieved by securely clamping the flange of the transistor so that good thermal contact is made to both top and bottom surfaces of the flange.

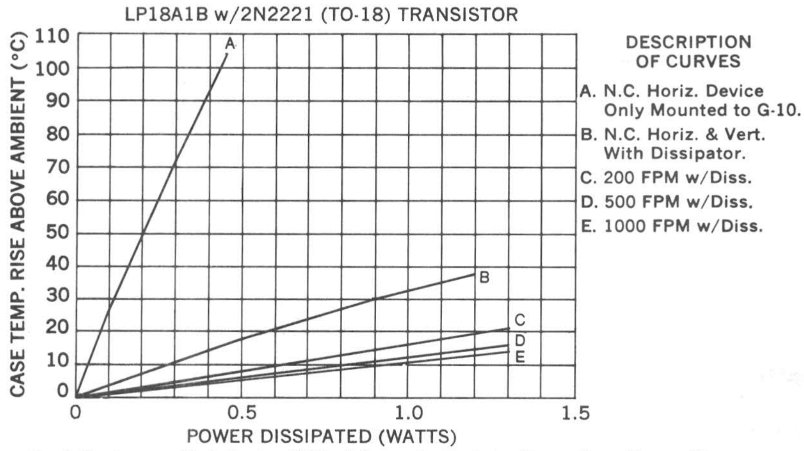
LP18 Series



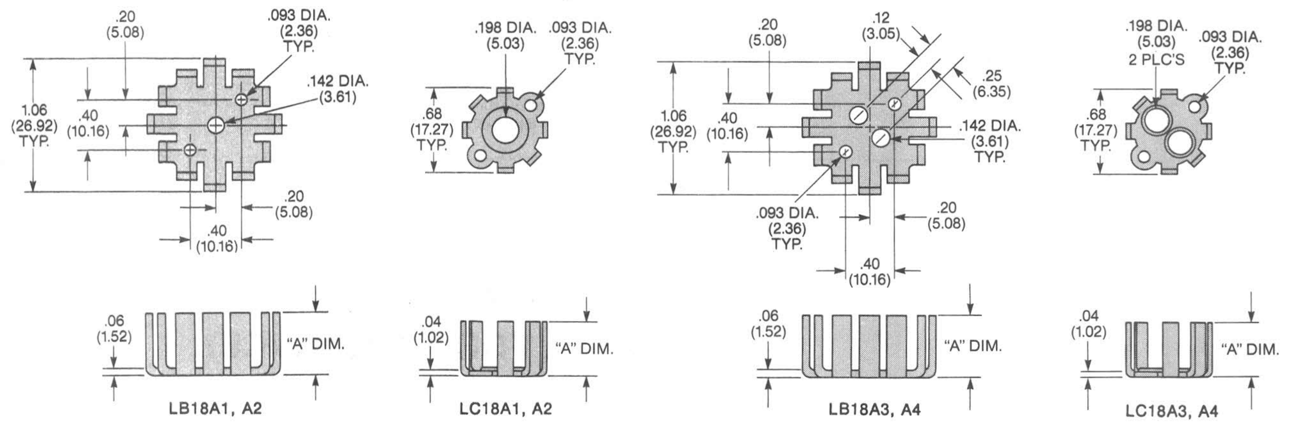
LB18A1



LB18A3



- For 2 Devices on Sink Assign 60% of Power to Each for Same Case Temp. Rise.
- Derate 18% for .31 Tall Part.
- Derate 1.5 °C/watt for unplated part in natural convection only.
- Derate 30.0 °C/watt for Insulube® part in natural convection only.



LB18A1, A2 LC18A1, A2 LB18A3, A4 LC18A3, A4

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

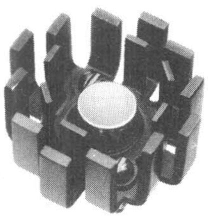
Item	IERC PART NO. Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize**	Insulube 448®**	Semiconductor Accommodated	"A" Dimension (Inches)	Mounting Hardware (see below)	Max. Weight (Grams)
2-pc. Dissipator	LP18A1U	LP18A1WCB	LP18A1B	LP18A1	One TO-18	.50	A-2 or B-2	6.0
2-pc. Dissipator	LP18A2U	LP18A2WCB	LP18A2B	LP18A2	One TO-18	.31	A-2 or B-2	4.2
2-pc. Dissipator	LP18A3U	LP18A3WCB	LP18A3B	LP18A3	Two TO-18s	.50	A-2 or B-2	5.8
2-pc. Dissipator	LP18A4U	LP18A4WCB	LP18A4B	LP18A4	Two TO-18s	.31	A-2 or B-2	4.0
Base	LB18A1U	LB18A1WCB	LB18A1B	LB18A1	N/A	.50	A-2 or B-2	4.8
Base	LB18A2U	LB18A2WCB	LB18A2B	LB18A2	N/A	.31	A-2 or B-2	3.4
Base	LB18A3U	LB18A3WCB	LB18A3B	LB18A3	N/A	.50	A-2 or B-2	4.8
Base	LB18A4U	LB18A4WCB	LB18A4B	LB18A4	N/A	.31	A-2 or B-2	3.2
Clamp	LC18A1U	LC18A1CB	LC18A1B	LC18A1	One TO-18	.44	A-2 or B-2	1.2
Clamp	LC18A2U	LC18A2CB	LC18A2B	LC18A2	One TO-18	.25	A-2 or B-2	0.8
Clamp	LC18A3U	LC18A3CB	LC18A3B	LC18A3	Two TO-18s	.44	A-2 or B-2	1.0
Clamp	LC18A4U	LC18A4CB	LC18A4B	LC18A4	Two TO-18s	.25	A-2 or B-2	0.8

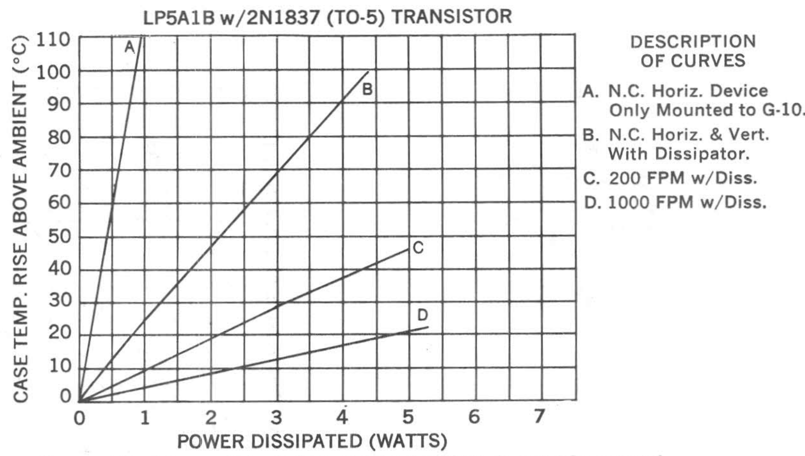
*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

Mounting Hardware Groups

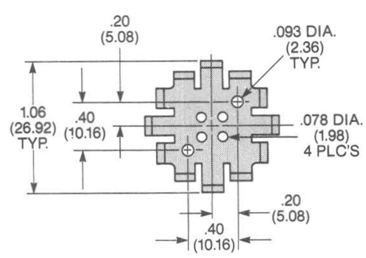
A-2 contains two sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-2 contains two sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-001 for Group A-2 and 309-002 for B-2.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

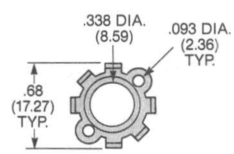
LP-A1 Series — Single Mount

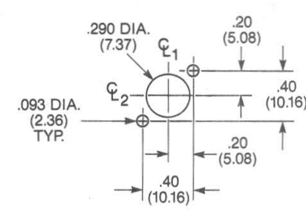


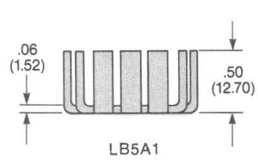


- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.6 °C/watt for Insulube® part in natural convection only.

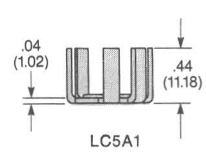








LB5A1



LC5A1

Hole pattern in base for TO-5 IC.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

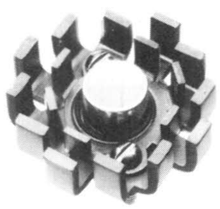
Item	IERC PART NO.				Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
	Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**			
2-pc. Dissipator	LP5A1U	LP5A1WCB	LP5A1B**	LP5A1	One TO-5	A-2 or B-2	5.6
2-pc. Dissipator	LP73A1U	LP73A1WCB	LP73A1WB*	LP73A1	One TO-5 IC	A-2 or B-2	5.6
Base	LB5A1U	LB5A1WCB	LB5A1B**	LB5A1	N/A	A-2 or B-2	4.5
Base	LB73A1U	LB73A1WCB	LB73A1WB*	LB73A1	N/A	A-2 or B-2	4.5
Clamp	LC5A1U	LC5A1CB	LC5A1B	LC5A1	One TO-5	A-2 or B-2	1.1

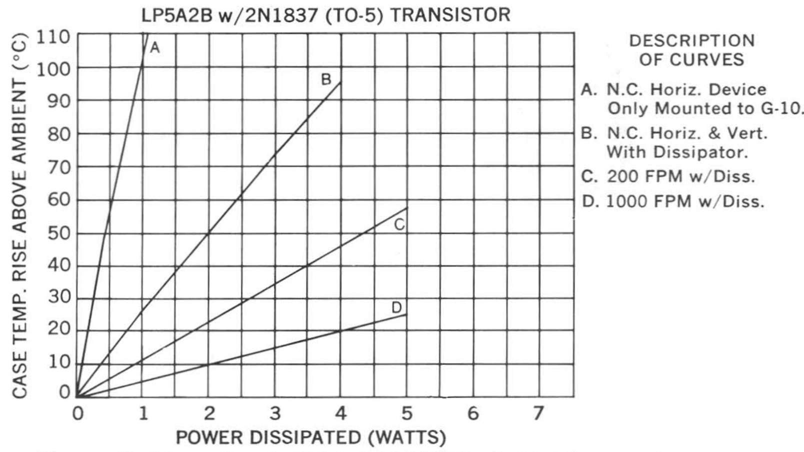
*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

Mounting Hardware Groups

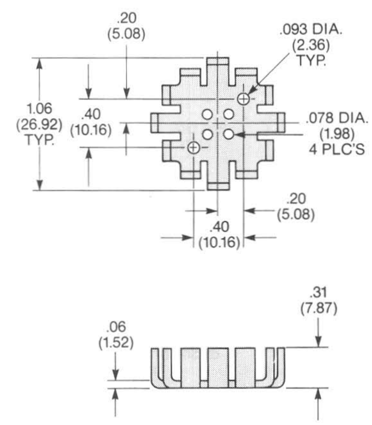
A-2 contains two sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-2 contains two sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-001 for Group A-2 and 309-002 for B-2.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

LP-A2 Series — Single Mount

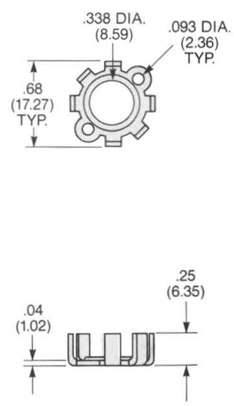




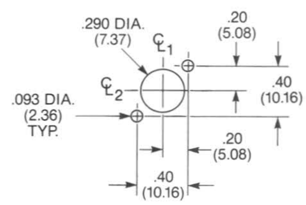
- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 3.6 °C/watt for Insulube® part in natural convection only.



LB5A2



LC5A2



Hole pattern in base for TO-5 IC.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

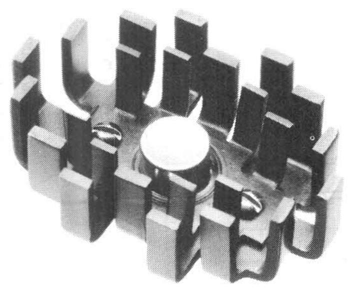
Item	IERC PART NO.				Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
	Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**			
2-pc. Dissipator	LP5A2U	LP5A2WCB	LP5A2B**	LP5A2	One TO-5	A-2 or B-2	4.0
2-pc. Dissipator	LP73A2U	LP73A2WCB	LP73A2WB*	LP73A2	One TO-5 IC	A-2 or B-2	4.0
Base	LB5A2U	LB5A2WCB	LB5A2B**	LB5A2	N/A	A-2 or B-2	3.3
Base	LB73A2U	LB73A2WCB	LB73A2WB*	LB73A2	N/A	A-2 or B-2	3.3
Clamp	LC5A2U	LC5A2CB	LC5A2B	LC5A2	One TO-5	A-2 or B-2	0.7

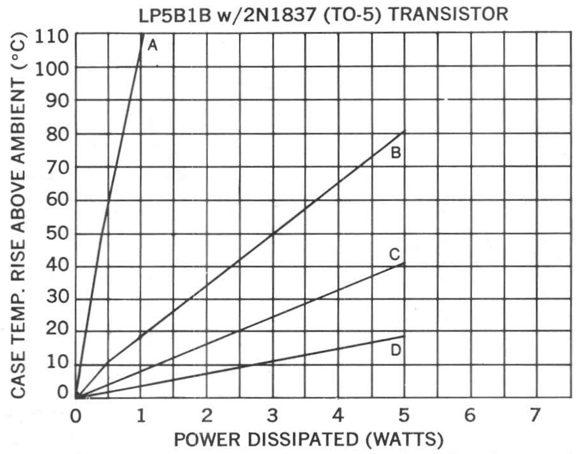
*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

Mounting Hardware Groups

A-2 contains two sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-2 contains two sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-001 for Group A-2 and 309-002 for B-2.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

LP-B1 Series — Single Mount

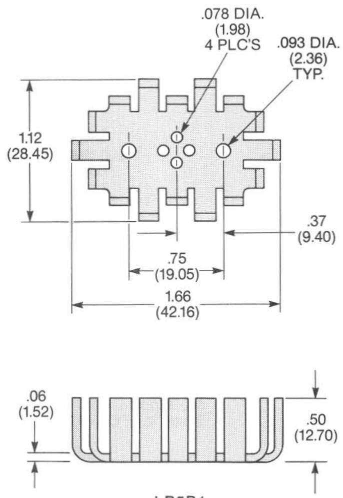




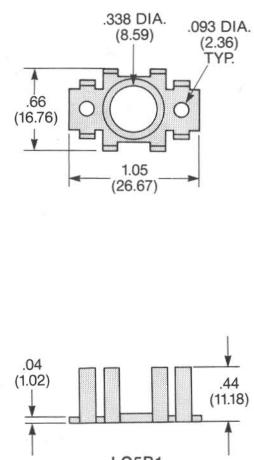
DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 1000 FPM w/Diss.

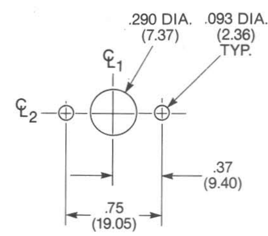
- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 3.6 °C/watt for Insulube® part in natural convection only.



LB5B1



LC5B1



Hole pattern in base for TO-5 IC.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

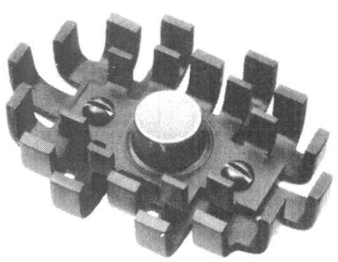
Item	IERC PART NO.				Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
	Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**			
2-pc. Dissipator	LP5B1U	LP5B1WCB	LP5B1B**	LP5B1	One TO-5	A-2 or B-2	8.1
2-pc. Dissipator	LP73B1U	LP73B1WCB	LP73B1WB*	LP73B1	One TO-5 IC	A-2 or B-2	8.1
Base	LB5B1U	LB5B1WCB	LB5B1B**	LB5B1	N/A	A-2 or B-2	6.6
Base	LB73B1U	LB73B1WCB	LB73B1WB*	LB73B1	N/A	A-2 or B-2	6.6
Clamp	LC5B1U	LC5B1CB	LC5B1B	LC5B1	One TO-5	A-2 or B-2	1.5

*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

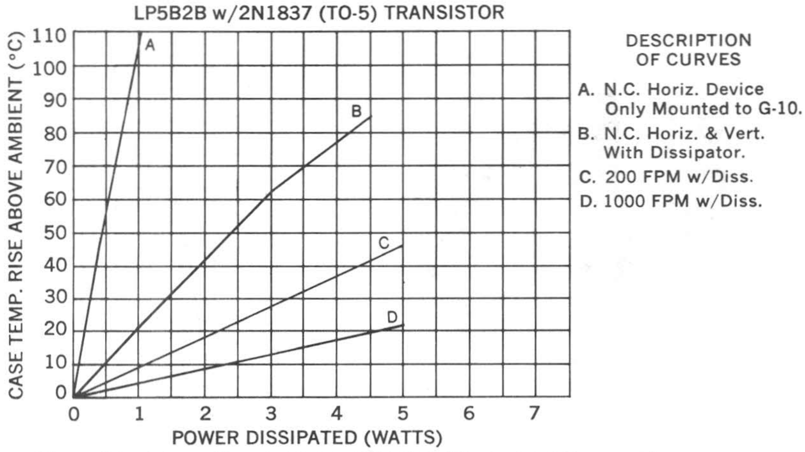
Mounting Hardware Groups

A-2 contains two sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-2 contains two sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-001 for Group A-2 and 309-002 for B-2.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

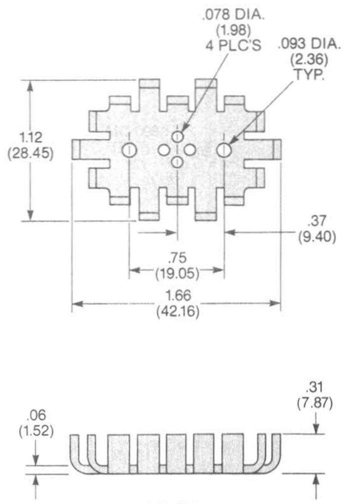
LP-B2 Series — Single Mount



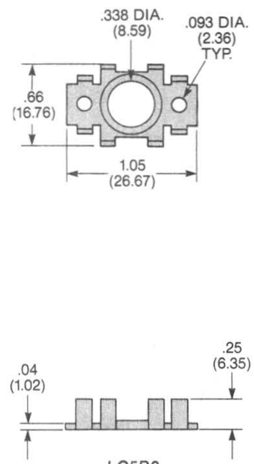
LP5B2B w/2N1837 (TO-5) TRANSISTOR



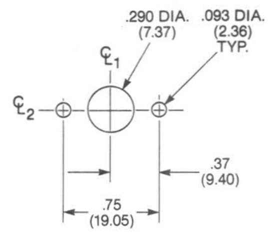
- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 3.6 °C/watt for Insulube® part in natural convection only.



LB5B2



LC5B2



Hole pattern in base for TO-5 IC.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

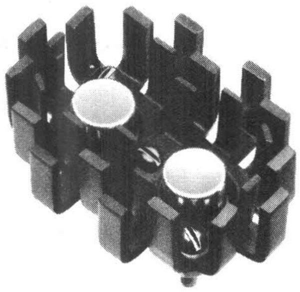
Item	IERC PART NO.				Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
	Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**			
2-pc. Dissipator	LP5B2U	LP5B2WCB	LP5B2B**	LP5B2	One TO-5	A-2 or B-2	6.4
2-pc. Dissipator	LP73B2U	LP73B2WCB	LP73B2WB*	LP73B2	One TO-5 IC	A-2 or B-2	6.4
Base	LB5B2U	LB5B2WCB	LB5B2B**	LB5B2	N/A	A-2 or B-2	5.2
Base	LB73B2U	LB73B2WCB	LB73B2WB*	LB73B2	N/A	A-2 or B-2	5.2
Clamp	LC5B2U	LC5B2CB	LC5B2B	LC5B2	One TO-5	A-2 or B-2	1.2

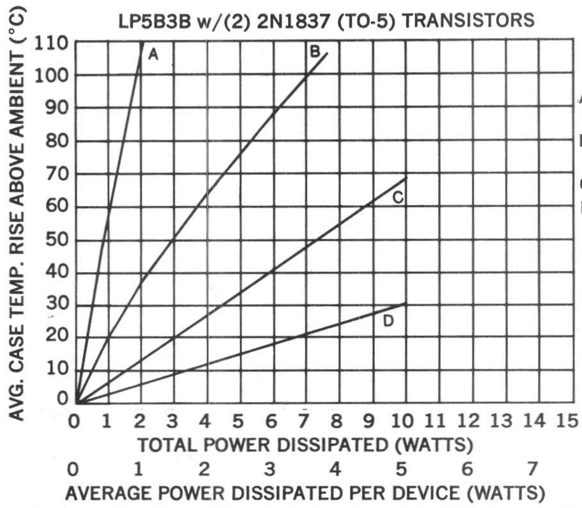
*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

Mounting Hardware Groups

A-2 contains two sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-2 contains two sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-001 for Group A-2 and 309-002 for B-2.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

LP-B3 Series — Dual Mount

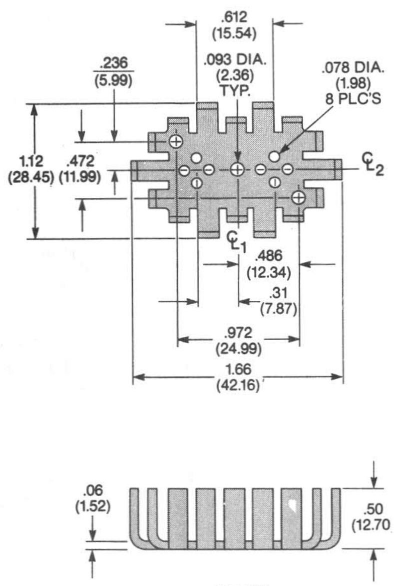




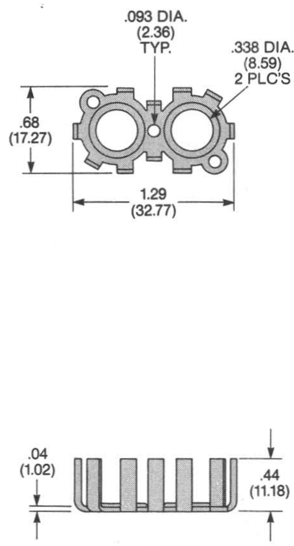
DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 1000 FPM w/Diss.

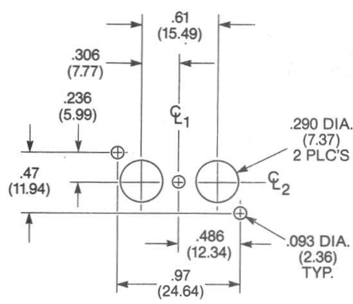
- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.8 °C/watt per device for unplated part in natural convection only.
- Derate 3.6 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.



LB5B3



LC5B3



Hole pattern in base for TO-5 IC.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

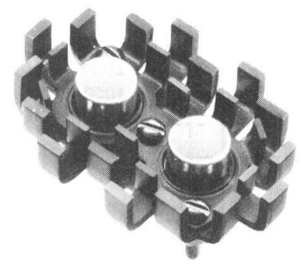
Item	IERC PART NO.				Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
	Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**			
2-pc. Dissipator	LP5B3U	LP5B3WCB	LP5B3B**	LP5B3	Two TO-5s	A-3 or B-3	8.4
2-pc. Dissipator	LP73B3U	LP73B3WCB	LP73B3WB*	LP73B3	Two TO-5 ICs	A-3 or B-3	8.4
Base	LB5B3U	LB5B3WCB	LB5B3B**	LB5B3	N/A	A-3 or B-3	6.5
Base	LB73B3U	LB73B3WCB	LB73B3WB*	LB73B3	N/A	A-3 or B-3	6.5
Clamp	LC5B3U	LC5B3CB	LC5B3B	LC5B3	Two TO-5s	A-3 or B-3	1.9

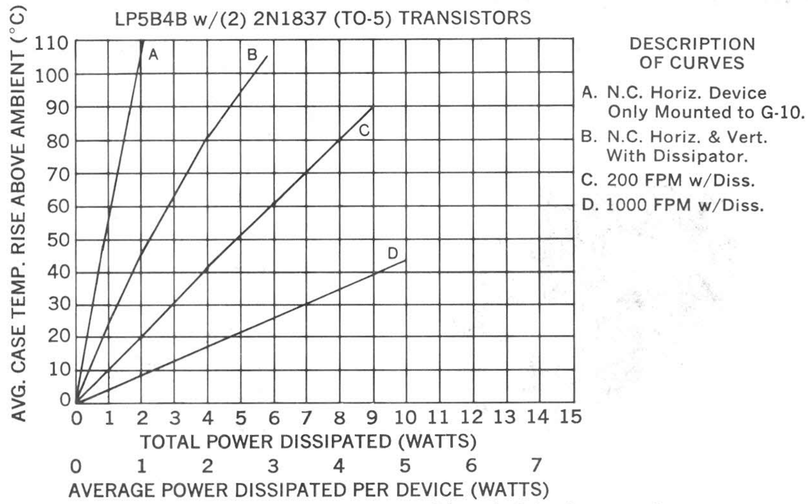
*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

Mounting Hardware Groups

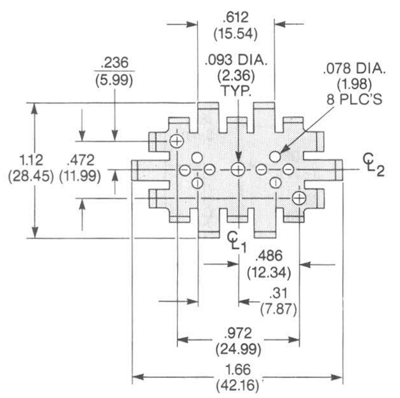
A-3 contains three sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-3 contains three sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-003 for Group A-3 and 309-004 for B-3.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

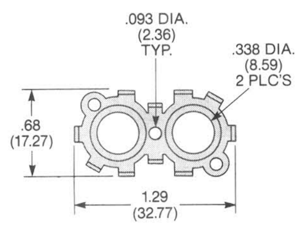
LP-B4 Series — Dual Mount

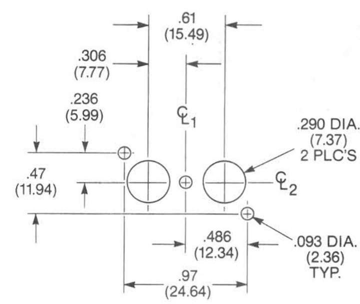




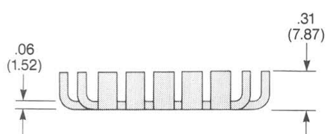
- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.7 °C/watt per device for unplated part in natural convection only.
- Derate 3.6 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.







Hole pattern in base for TO-5 IC.



LB5B4

LC5B4

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

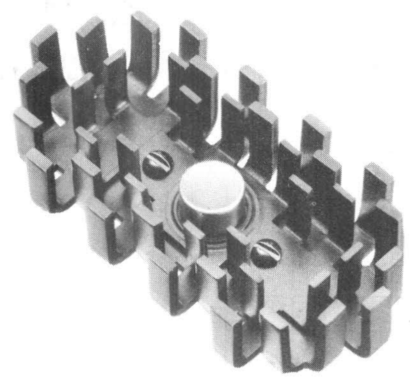
Item	IERC PART NO.				Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
	Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**			
2-pc. Dissipator	LP5B4U	LP5B4WCB	LP5B4B**	LP5B4	Two TO-5s	A-3 or B-3	6.3
2-pc. Dissipator	LP73B4U	LP73B4WCB	LP73B4WB*	LP73B4	Two TO-5 ICs	A-3 or B-3	6.3
Base	LB5B4U	LB5B4WCB	LB5B4B**	LB5B4	N/A	A-3 or B-3	5.0
Base	LB73B4U	LB73B4WCB	LB73B4WB*	LB73B4	N/A	A-3 or B-3	5.0
Clamp	LC5B4U	LC5B4CB	LC5B4B	LC5B4	Two TO-5s	A-3 or B-3	1.3

*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

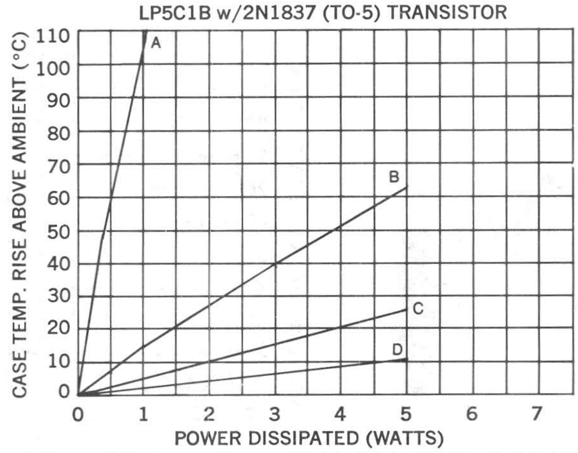
Mounting Hardware Groups

A-3 contains three sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-3 contains three sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-003 for Group A-3 and 309-004 for B-3.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

LP-C1 Series — Single Mount



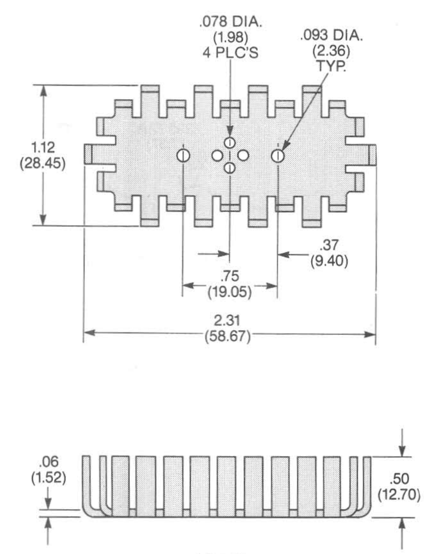
LP5C1B w/2N1837 (TO-5) TRANSISTOR



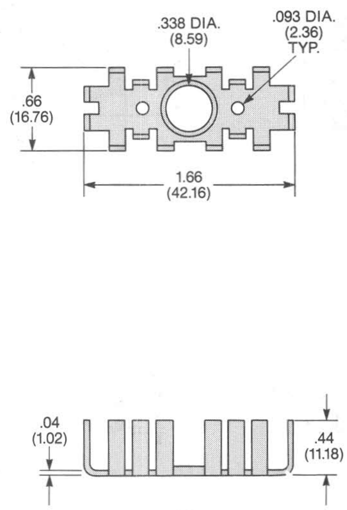
DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 1000 FPM w/Diss.

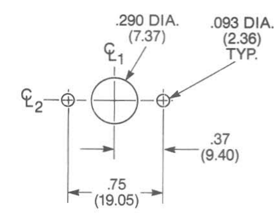
- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.9 °C/watt for unplated part in natural convection only.
- Derate 3.6 °C/watt for Insulube® part in natural convection only.



LB5C1



LC5C1



Hole pattern in base for TO-5 IC.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

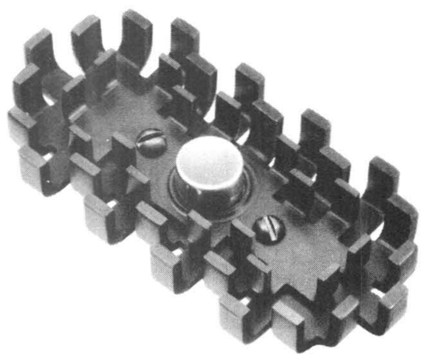
Item	IERC PART NO.				Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
	Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**			
2-pc. Dissipator	LP5C1U	LP5C1WCB	LP5C1B**	LP5C1	One TO-5	A-2 or B-2	13.1
2-pc. Dissipator	LP73C1U	LP73C1WCB	LP73C1WB*	LP73C1	One TO-5 IC	A-2 or B-2	13.1
Base	LB5C1U	LB5C1WCB	LB5C1B**	LB5C1	N/A	A-2 or B-2	10.0
Base	LB73C1U	LB73C1WCB	LB73C1WB*	LB73C1	N/A	A-2 or B-2	10.0
Clamp	LC5C1U	LC5C1CB	LC5C1B	LC5C1	One TO-5	A-2 or B-2	3.1

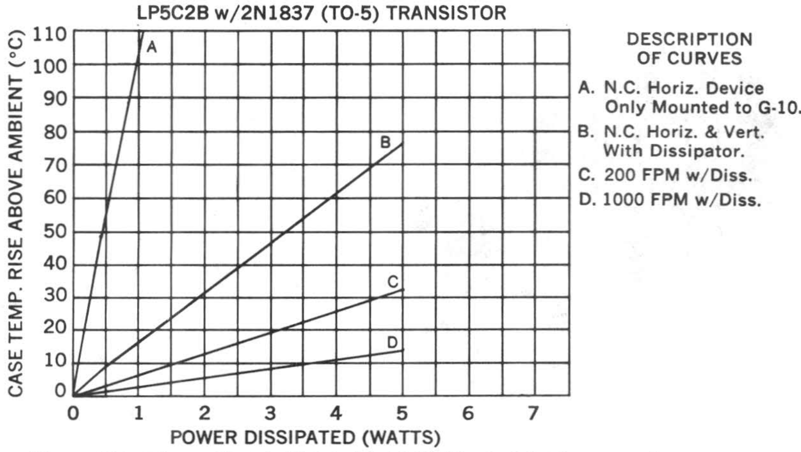
*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

Mounting Hardware Groups

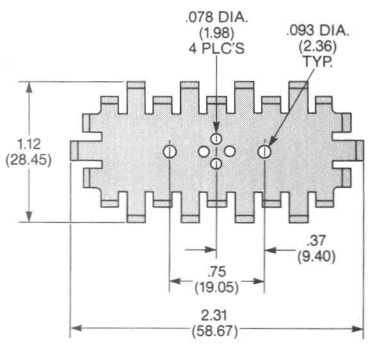
A-2 contains two sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-2 contains two sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-001 for Group A-2 and 309-002 for B-2.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

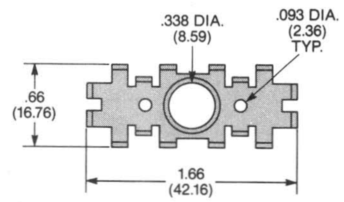
LP-C2 Series — Single Mount

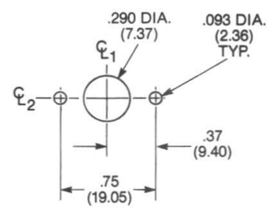




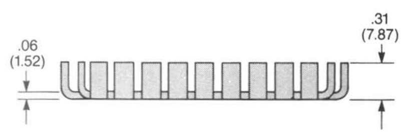
- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.9 °C/watt for unplated part in natural convection only.
- Derate 3.6 °C/watt for Insulube® part in natural convection only.



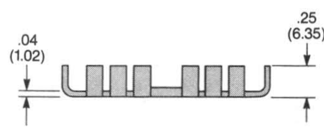




Hole pattern in base for TO-5 IC.



LB5C2



LC5C2

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

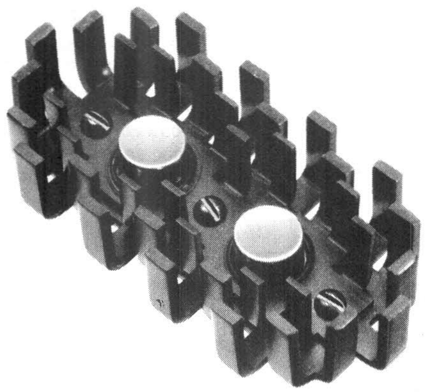
Item	IERC PART NO. Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**	Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
2-pc. Dissipator	LP5C2U	LP5C2WCB	LP5C2B**	LP5C2	One TO-5	A-2 or B-2	10.1
2-pc. Dissipator	LP73C2U	LP73C2WCB	LP73C2WB*	LP73C2	One TO-5 IC	A-2 or B-2	10.1
Base	LB5C2U	LB5C2WCB	LB5C2B**	LB5C2	N/A	A-2 or B-2	7.9
Base	LB73C2U	LB73C2WCB	LB73C2WB*	LB73C2	N/A	A-2 or B-2	7.9
Clamp	LC5C2U	LC5C2CB	LC5C2B	LC5C2	One TO-5	A-2 or B-2	2.2

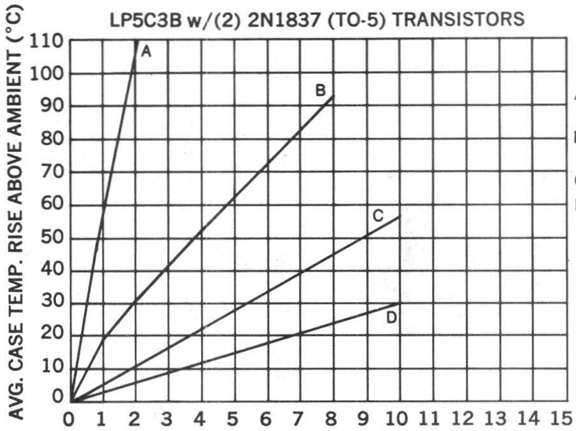
*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

Mounting Hardware Groups

A-2 contains two sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-2 contains two sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-001 for Group A-2 and 309-002 for B-2.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

LP-C3 Series — Dual Mount

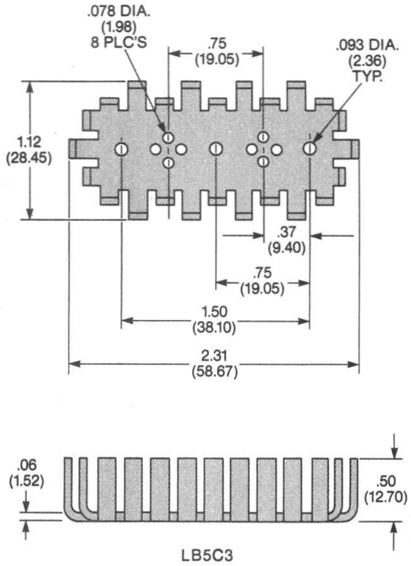


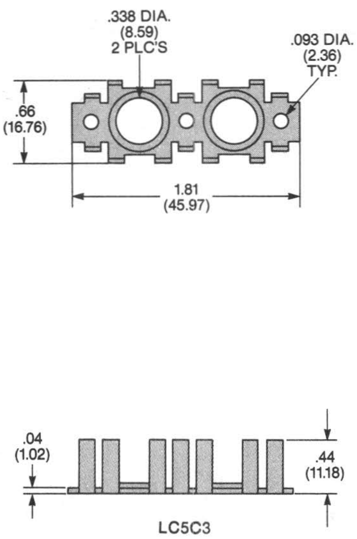


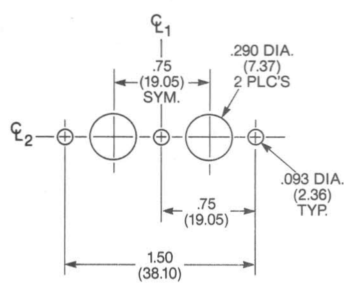
DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.9 °C/watt per device for unplated part in natural convection only.
- Derate 3.6 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.







Hole pattern in base for TO-5 IC.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

Item	IERC PART NO. Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**	Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
2-pc. Dissipator	LP5C3U	LP5C3WCB	LP5C3B**	LP5C3	Two TO-5s	A-3 or B-3	12.8
2-pc. Dissipator	LP73C3U	LP73C3WCB	LP73C3WB*	LP73C3	Two TO-5 ICs	A-3 or B-3	12.8
Base	LB5C3U	LB5C3WCB	LB5C3B**	LB5C3	N/A	A-3 or B-3	10.0
Base	LB73C3U	LB73C3WCB	LB73C3WB*	LB73C3	N/A	A-3 or B-3	10.0
Clamp	LC5C3U	LC5C3CB	LC5C3B	LC5C3	Two TO-5s	A-3 or B-3	2.8

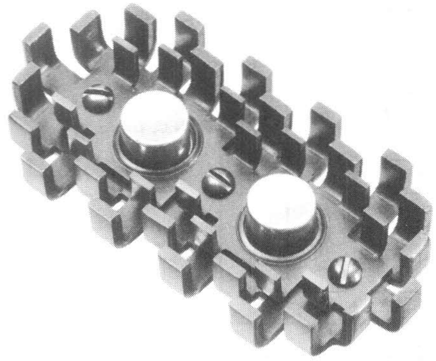
*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

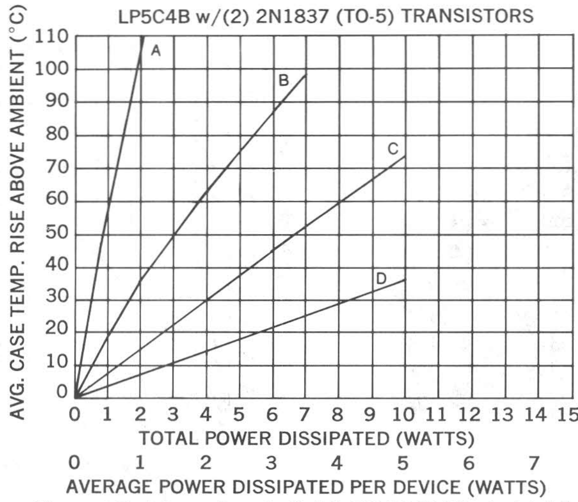
Mounting Hardware Groups

A-3 contains three sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-3 contains three sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-003 for Group A-3 and 309-004 for B-3.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

LP-C4 Series — Dual Mount

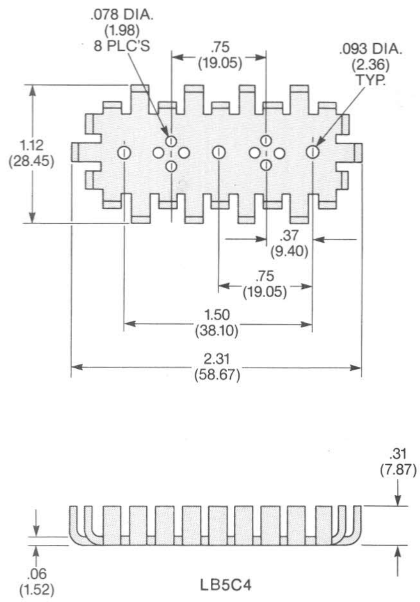


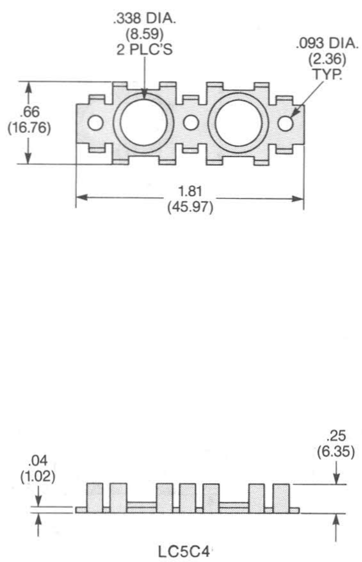


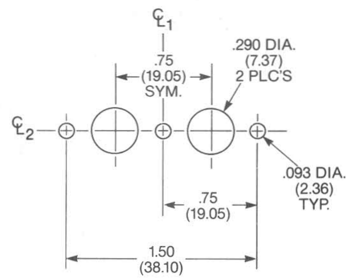
DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.0-4.0 °C/W w/o Joint Compound.
- Derate 0.9 °C/watt per device for unplated part in natural convection only.
- Derate 3.6 °C/watt per device for Insulube® part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.







Hole pattern in base for TO-5 IC.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

Item	IERC PART NO.				Semiconductor Accommodated	Mounting Hardware (see below)	Max. Weight (Grams)
	Unplated*	Comm'l. Black Anodize*	Mil. Black Anodize	Insulube 448®**			
2-pc. Dissipator	LP5C4U	LP5C4WCB	LP5C4B**	LP5C4	Two TO-5s	A-3 or B-3	10.0
2-pc. Dissipator	LP73C4U	LP73C4WCB	LP73C4WB*	LP73C4	Two TO-5 ICs	A-3 or B-3	10.0
Base	LB5C4U	LB5C4WCB	LB5C4B**	LB5C4	N/A	A-3 or B-3	7.8
Base	LB73C4U	LB73C4WCB	LB73C4WB*	LB73C4	N/A	A-3 or B-3	7.8
Clamp	LC5C4U	LC5C4CB	LC5C4B	LC5C4	Two TO-5s	A-3 or B-3	2.2

*Lead holes in base uninsulated.
**Lead holes in base are insulated.
Note: Clamps may be used separately as retaining devices.

Mounting Hardware Groups

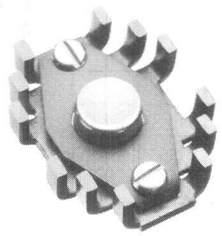
A-3 contains three sets of 2-56 brass screws, nuts and washers, black cadmium plated.
B-3 contains three sets of 2-56 nylon screws, nuts and washers.
When hardware is listed separately on purchase orders, specify Stock No. 309-003 for Group A-3 and 309-004 for B-3.
Recommended torques: When using brass hardware torque to 3 inch pounds; with nylon hardware, torque to 2 to 3 inch ounces.

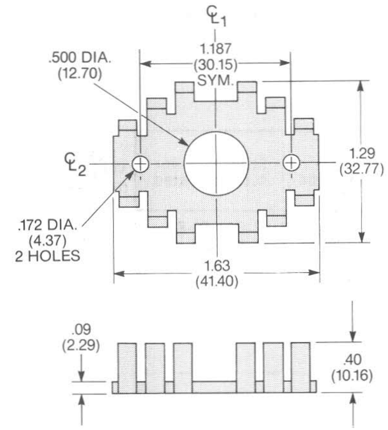
Heat dissipators/clamps for TO-8s and TO-8 ICs

- Increases power levels 6 to 8 times over operation without dissipator; high dissipation achieved with forced air.
- Accommodates multi-functional ICs packaged in TO-8 style metal cases with diameters up to .550″ and circular or square lead patterns to .400″.
- Positive case retention and heat transfer are achieved by the clamp, which contacts the entire circumference of the case, exerting uniform pressure on the IC to assure maximum thermal transfer.

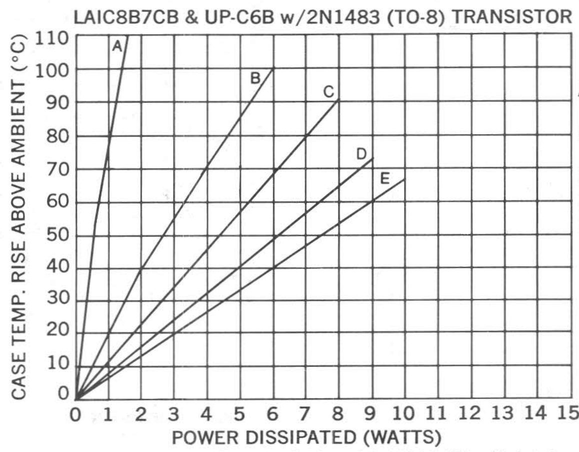
LAIC8B7

(Clamp required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.3-2.5 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

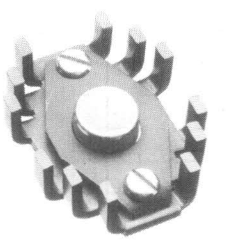
Ordering Information

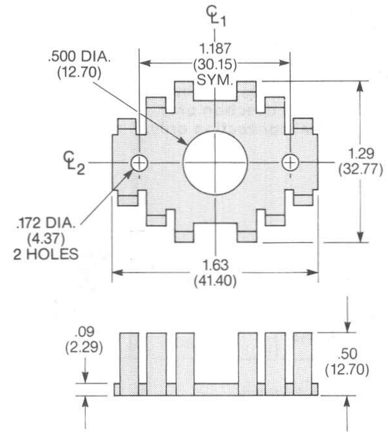
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LAIC8B7U	LAIC8B7CB	LAIC8B7B	LAIC8B7	One TO-8 or TO-8 IC	7.8

Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

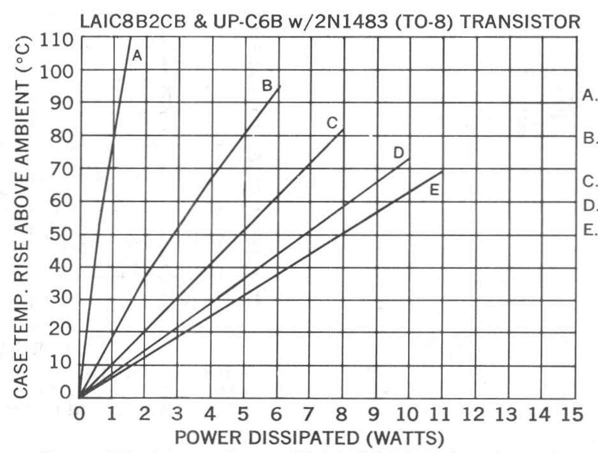
LAIC8B2

(Clamp required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.3-2.5 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

Ordering Information

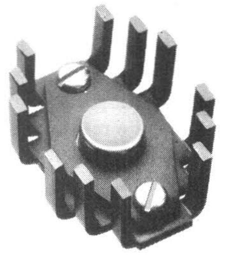
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LAIC8B2U	LAIC8B2CB	LAIC8B2B	LAIC8B2	One TO-8 or TO-8 IC	8.7

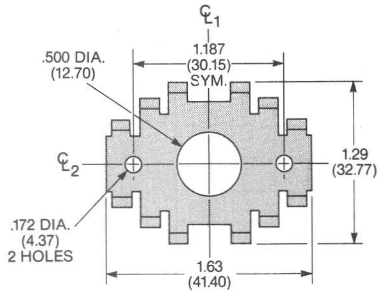
Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

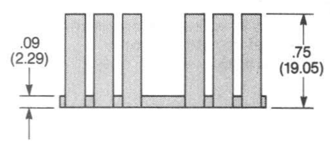
HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

LAIC8B3

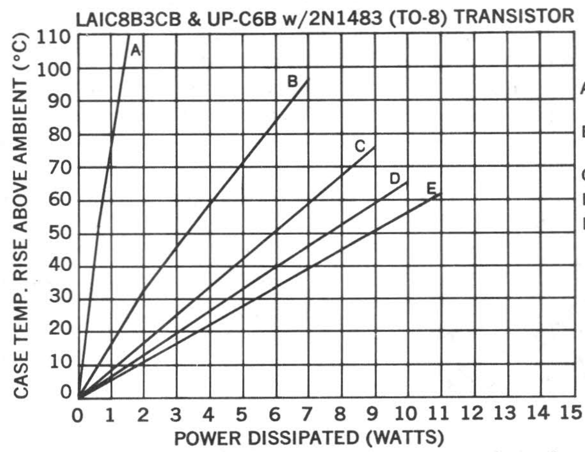
(Clamp required. See note.)







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.3-2.5 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

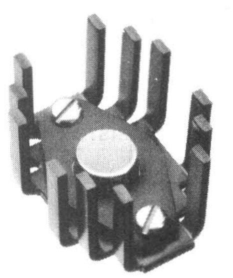
Ordering Information

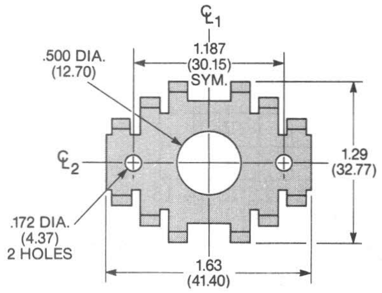
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LAIC8B3U	LAIC8B3CB	LAIC8B3B	LAIC8B3	One TO-8 or TO-8 IC	10.8

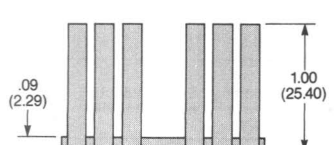
Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

LAIC8B4

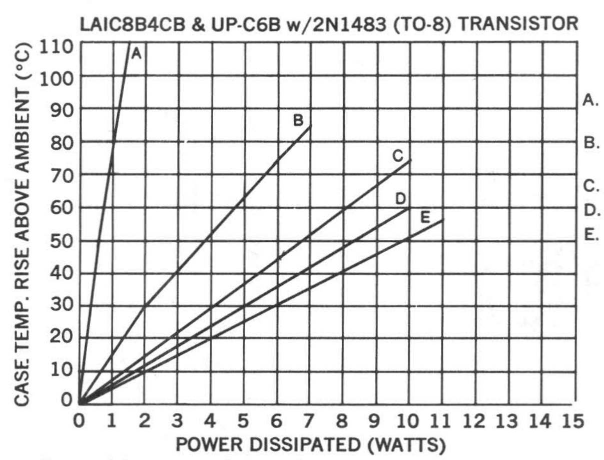
(Clamp required. See note.)







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.3-2.5 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

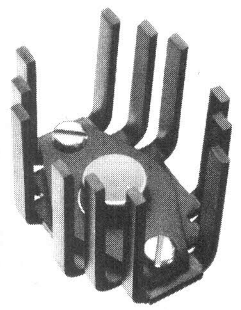
Ordering Information

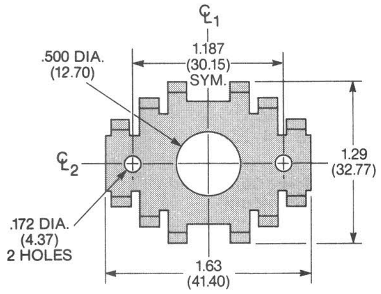
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LAIC8B4U	LAIC8B4CB	LAIC8B4B	LAIC8B4	One TO-8 or TO-8 IC	12.9

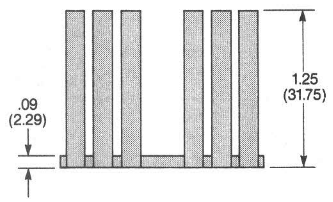
Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

LAIC8B5

(Clamp required. See note.)

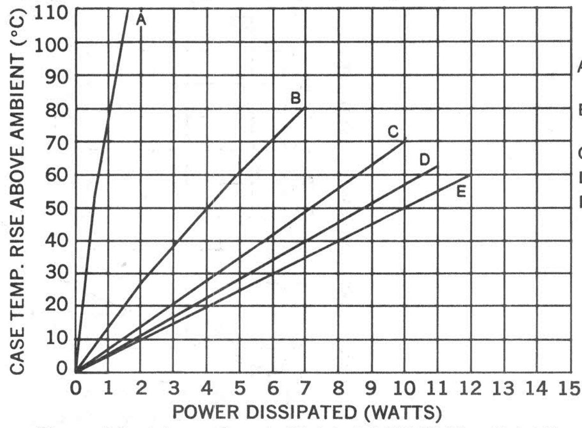






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LAIC8B5CB & UP-C6B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.3-2.5 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

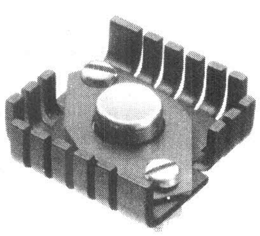
Ordering Information

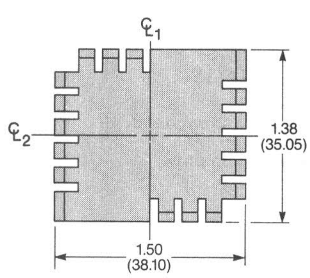
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LAIC8B5U	LAIC8B5CB	LAIC8B5B	LAIC8B5	One TO-8 or TO-8 IC	15.1

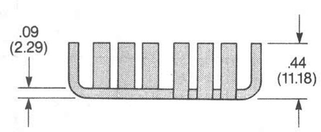
Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

UP3-TO8 Series

(Clamp required. See note.)

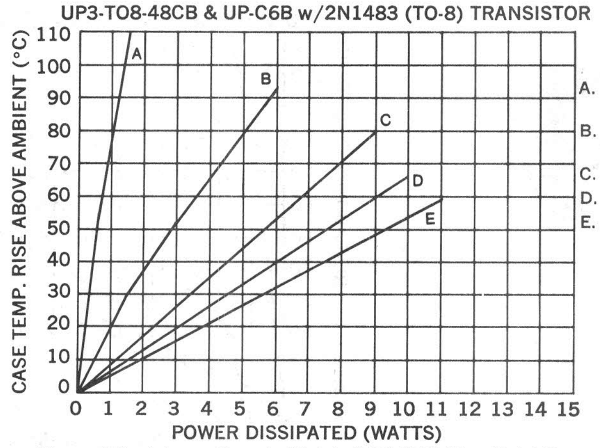






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP3-TO8-48CB & UP-C6B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 1.2-1.7 °C/W w/Joint Compound.
- Derate 0.6 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

Ordering Information

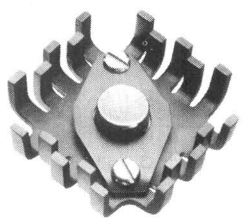
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 3-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
UP3-T08-U	UP3-T08-CB	UP3-T08-B	UP3-T08	One TO-8	1	10.5
UP3-T08-48U	UP3-T08-48CB	UP3-T08-48B	UP3-T08-48	One TO-8 IC	4	10.5
UP3-T08-51U	UP3-T08-51CB	UP3-T08-51B	UP3-T08-51	One TO-8 IC	5	10.5

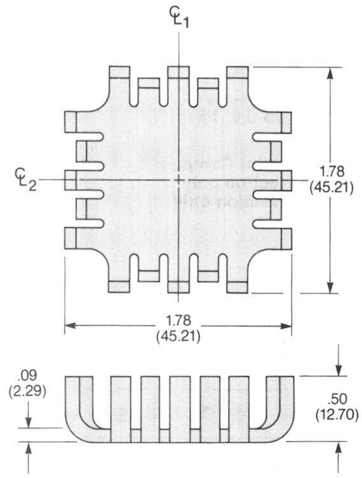
Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

UP1-TO8 Series

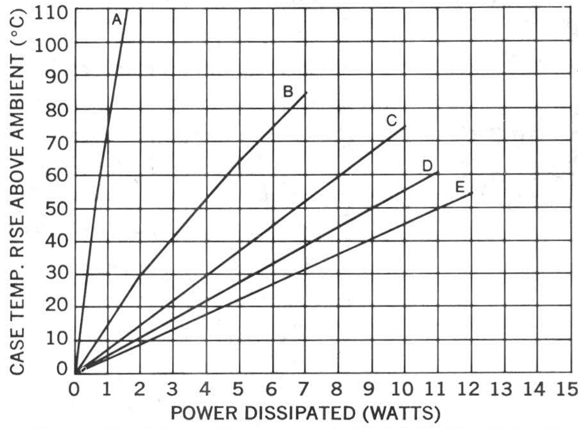
(Clamp required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP1-TO8-48CB & UP-C6B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 1.2-1.7 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

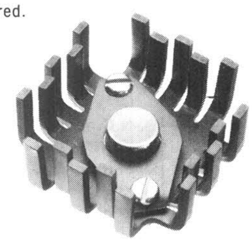
Ordering Information

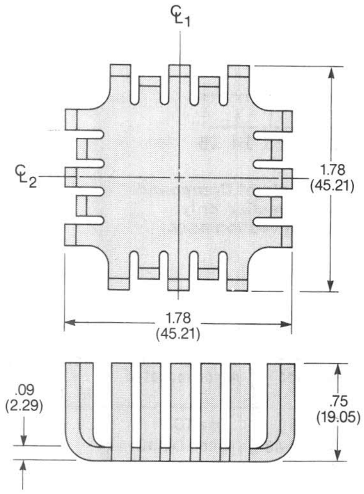
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 3-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
UP1-TO8-U	UP1-TO8-CB	UP1-TO8-B	UP1-TO8	One TO-8	1	15.5
UP1-TO8-48U	UP1-TO8-48CB	UP1-TO8-48B	UP1-TO8-48	One TO-8 IC	2	15.5
UP1-TO8-51U	UP1-TO8-51CB	UP1-TO8-51B	UP1-TO8-51	One TO-8 IC	3	15.5

Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

UP2-TO8 Series

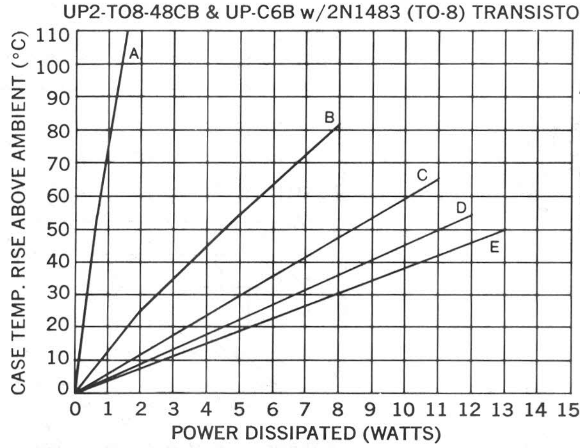
(Clamp required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP2-TO8-48CB & UP-C6B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 1.2-1.7 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

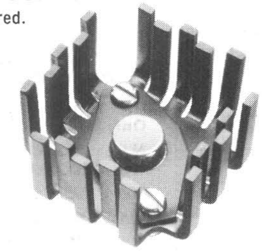
Ordering Information

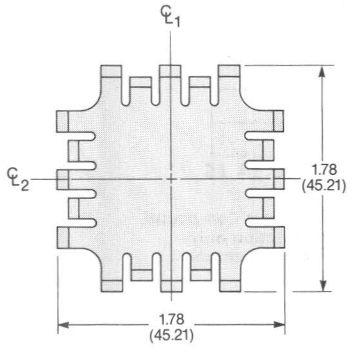
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 3-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
UP2-TO8-U	UP2-TO8-CB	UP2-TO8-B	UP2-TO8	One TO-8	1	19.1
UP2-TO8-48U	UP2-TO8-48CB	UP2-TO8-48B	UP2-TO8-48	One TO-8 IC	2	19.1
UP2-TO8-51U	UP2-TO8-51CB	UP2-TO8-51B	UP2-TO8-51	One TO-8 IC	3	19.1

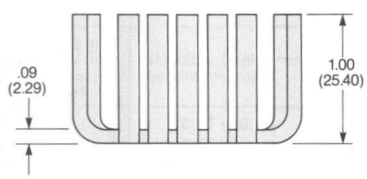
Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

UP-TO8 Series

(Clamp required. See note.)

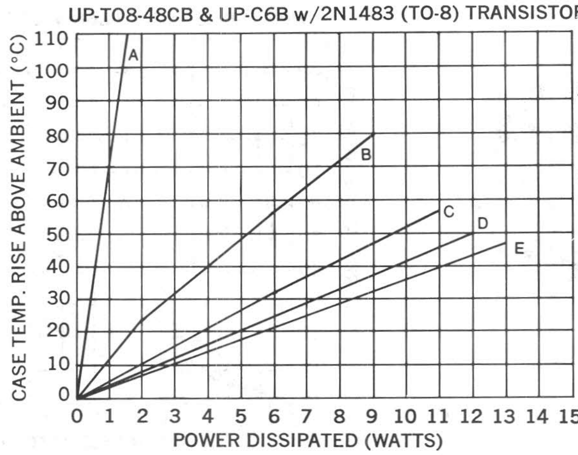






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

UP-TO8-48CB & UP-C6B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 1.2-1.7 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

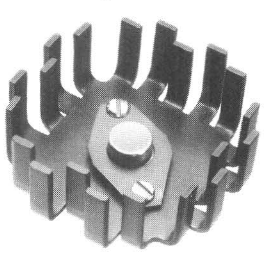
Ordering Information

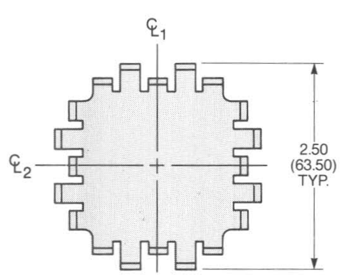
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 3-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
UP-TO8-U	UP-TO8-CB	UP-TO8-B	UP-TO8	One TO-8	1	22.5
UP-TO8-48U	UP-TO8-48CB	UP-TO8-48B	UP-TO8-48	One TO-8 IC	2	22.5
UP-TO8-51U	UP-TO8-51CB	UP-TO8-51B	UP-TO8-51	One TO-8 IC	3	22.5

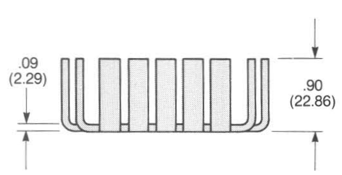
Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

HP1-TO8 Series

(Clamp required. See note.)

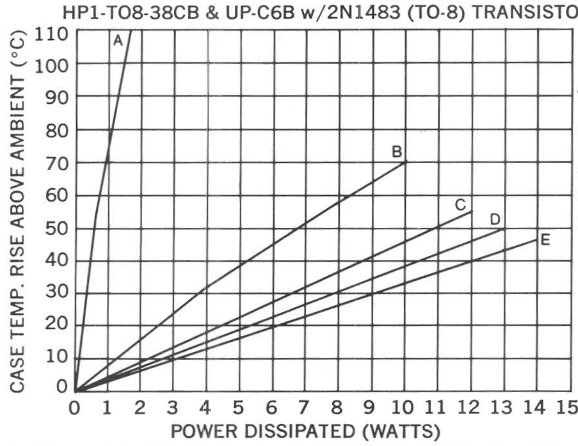






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HP1-TO8-38CB & UP-C6B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 1.2-1.7 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

Ordering Information

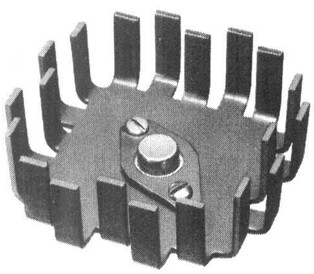
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 3-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
HP1-TO8-U	HP1-TO8-CB	HP1-TO8-B	HP1-TO8	One TO-8	1	35.0
HP1-TO8-38U	HP1-TO8-38CB	HP1-TO8-38B	HP1-TO8-38	One TO-8 IC	2	35.0
HP1-TO8-48U	HP1-TO8-48CB	HP1-TO8-48B	HP1-TO8-48	One TO-8 IC	3	35.0

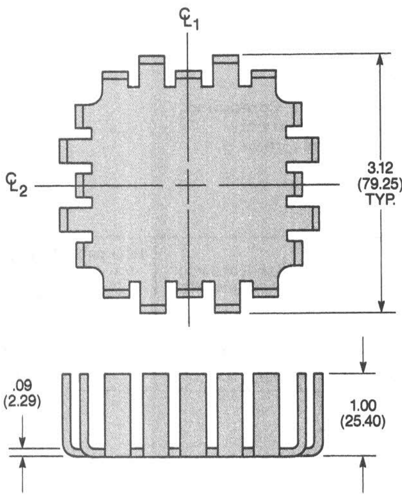
Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.

HEAT DISSIPATORS FOR METAL CASE, LEAD-MOUNTED SEMICONDUCTORS

HP3-TO8 Series

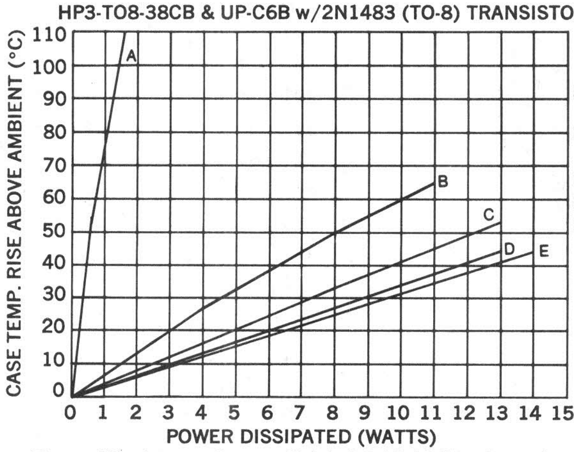
(Clamp required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

HP3-TO8-38CB & UP-C6B w/2N1483 (TO-8) TRANSISTOR



DESCRIPTION OF CURVES

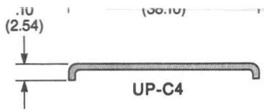
A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

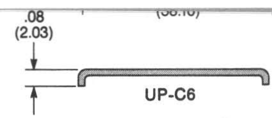
- Thermal Resistance Case to Sink is 1.2-1.7 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 2.3 °C/watt for Insulube® part in natural convection only.

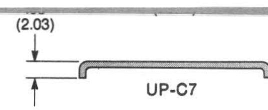
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 3-27)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
HP3-TO8-U	HP3-TO8-CB	HP3-TO8-B	HP3-TO8	One TO-8	1	55.0
HP3-TO8-38U	HP3-TO8-38CB	HP3-TO8-38B	HP3-TO8-38	One TO-8 IC	2	55.0
HP3-TO8-48U	HP3-TO8-48CB	HP3-TO8-48B	HP3-TO8-48	One TO-8 IC	3	55.0

Note: Clamp is required and must be ordered separately.
See page 3-27 for ordering information and dimensional drawings.







Ordering Information

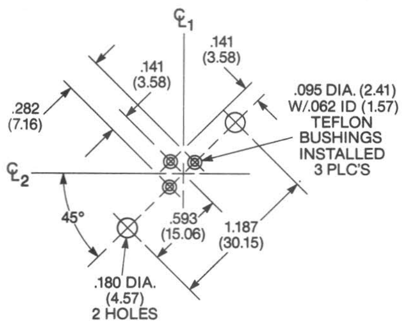
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
UP-C4U	UP-C4CB	UP-C4B	UP-C4	One TO-8 or TO-8 IC	2.0
UP-C6U	UP-C6CB	UP-C6B	UP-C6	One TO-8 or TO-8 IC	2.0
UP-C7U	UP-C7CB	UP-C7B	UP-C7	One TO-8 or TO-8 IC	2.0

Note: Clamp can be used separately.

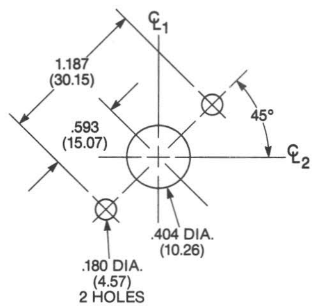
HOLE PATTERNS

IMPORTANT: To select the proper hole pattern, lead configuration must be considered.

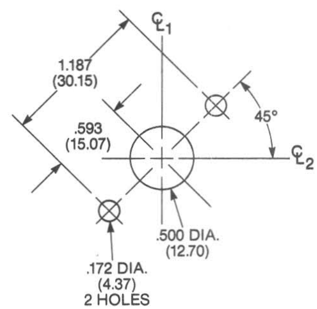
1. Hole pattern no. 7 accommodates TO-8s. Available in UP, UP1, UP2, UP3, HP1 and HP3 dissipators.



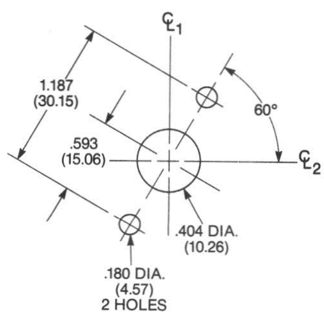
2. Hole pattern no. 200 accommodates TO-8s and TO-8 ICs. Available in UP, UP1, UP2 and HP series heat dissipators.



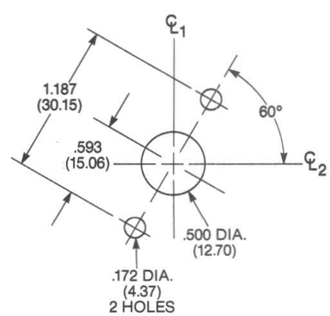
3. Hole pattern no. 223 accommodates TO-8s and TO-8 ICs. Available in UP, UP1, UP2 and HP series heat dissipators.



4. Hole pattern no. 372 accommodates TO-8s and TO-8 ICs. Available in UP3 series heat dissipators only.



5. Hole pattern no. 224 accommodates TO-8s and TO-8 ICs. Available in UP3 series heat dissipators only.

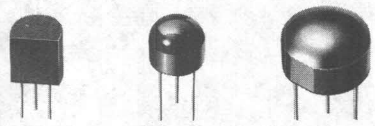


SECTION 4

HEAT DISSIPATORS FOR PLASTIC CASE, LEAD-MOUNTED SEMICONDUCTORS

SECTION 4

HEAT DISSIPATORS FOR PLASTIC CASE, LEAD-MOUNTED SEMICONDUCTORS



Determining the appropriate heat dissipator for a plastic case, lead-mounted semiconductor (TO-92, TO-98, TO-105, TO-106, and similar case devices) can be readily accomplished using the index on the next page.

The index is arranged according to increasing power dissipation capability (decreasing thermal resistance). An Index by Board Area requirements was not included in this section because the dissipators require little or no additional board space.

Using the index, it becomes a simple matter to locate a number of dissipators with similar, desirable thermal specifications.

All thermal resistance data contained in these indices (unless otherwise noted) is based on 60°C case temperature rise above ambient in natural convection, and at 50°C case rise above ambient in forced-air at 1000 fpm air velocity.

It is also important to remember that the thermal resistance values listed in the index are given for reference only. It is intended to help the engineer "zero in" on a suitable dissipator and should not be used to predict actual thermal performance.

The IERC dissipators illustrated in this section can solve a wide variety of thermal management problems, when they are chosen carefully.

In order to select the proper heat dissipator for a particular application, simply follow the formula outlined below to determine the correct heat dissipator part number.

1. Determine maximum anticipated power dissipation.
2. Determine maximum allowable temperature rise by subtracting the maximum ambient temperature (design ambient) from the maximum case temperature you wish to maintain. The maximum allowable case temperature may be determined by obtaining the maximum operating junction temperature and the thermal resistance from junction-to-case (θ_{jc}) from the semiconductor manufacturer's data sheet. The maximum case temperature is the maximum junction temperature minus the product of the thermal resistance junction-to-case and the maximum power dissipation anticipated.

   $$T_c = T_j - \theta_{j\text{-}c} P_{diss}$$

   It is frequent practice to hold the case temperature to less than the maximum allowable temperature in order to increase component reliability. For a more detailed explanation, see "Principles of Thermal Management" in this catalog.
3. Determine allowable thermal resistance from case-to-ambient by dividing allowable temperature rise by the maximum power dissipation (°C/W).
4. Determine desired mounting orientation, either free standing or vertical mount (when mechanical retention is required).
5. Determine whether you wish to mount two semiconductors on one sink for thermal matching and space utilization. One dissipator for two semiconductors often uses less space than two heat sinks.
6. Will the dissipator be used in natural convection or forced air — if so, at what velocity? Dissipator efficiency can be greatly increased when forced air is used (See index, this page).
7. Select a dissipator from the thermal resistance table and turn to page indicated. From the graph of case temperature rise above ambient determine actual case temperature for given power dissipation. You will note that heat dissipator thermal resistance can vary with power level and dissipator temperature. Is this temperature rise acceptable? If not, consult the thermal resistance index to find a dissipator with a slightly lower thermal resistance.
8. From the ordering information select the material and finish desired. Note that an unplated part will run hotter than a black part in natural convection by the amount given in the rating factors.

   Other factors regarding dissipator efficiency and selection parameters are covered in "Principles of Thermal Management."

   The following example illustrates this simple procedure:

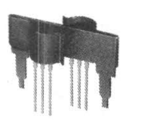
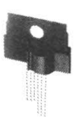
   Problem: To cool a TO-98 case transistor that will dissipate .190 watts. From the transistor data sheet we determine that:

   $$T_{j\,max.} = 150°C \text{ and}$$
   $$\theta_{j\text{-}c} = 357\ °C/W$$
   $$\text{Max. Case Temp.} = 150°C - (357\ °C/\text{watt} \times .190 \text{ watts}) = 82°C$$

   For increased reliability and a safety factor, we set the design case temperature at 80°C. A design ambient of 50°C is set. Therefore, max. allowable temperature rise is 30°C. This makes the max. allowable thermal resistance 157.9 °C/watt.

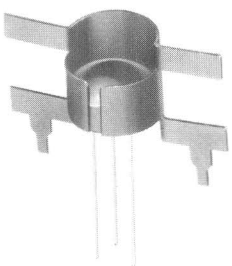
Assuming that forced air is not available, the design must be for natural convection. In looking down the index, the TX20 Series Fan Top dissipator would work; however, in this case we would like to have some mechanical retention as well as heat dissipation. The RU67 Series should provide more than adequate cooling and will securely fasten the device to the circuit board. Referring to the thermal performance curve for the RU671B on page 4-5 we find that a 28°C case rise above ambient can be expected at .190 watts. This favorably compares with our design case temperature rise of 30°C and even better performance can be obtained from the RU Series dissipators when they are soldered into the circuit board.

INDEX BY THERMAL RESISTANCE

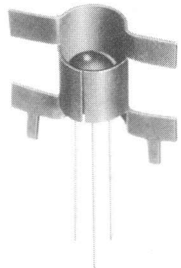
Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page	Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page
D-Case Plastic					**D-Case Plastic (cont.)**				
Free-standing Single Mount	TX	153.0	76.9	4-5	Solder-in Dual Mount	RU672	87.2[1,2]	35.7[2]	4-7
	RUR671	140.4[3]	54.6[3]	4-7		R20-2	82.9[2]	60.3[2]	4-5
Free-standing Dual Mount	RUR672	74.3[2]	29.4[2]	4-8	**Round Ceramic Case**				
					Fan Top	TX	150.0	76.7	4-5
Solder-in Single Mount	RU671	146.8[1]	68.2[1]	4-6					
	R20-1	136.6	73.3	4-4	Screw Mount Clip	RC	104.9	N/A	4-6
									

Notes: [1] Thermal resistance based on 40°C case rise above ambient.
[2] System thermal resistance (dissipator accommodates two devices): $\theta \text{ system} = \frac{\text{Average case rise}}{\text{Total power dissipated}}$
[3] Thermal resistance based on 50°C case rise above ambient.

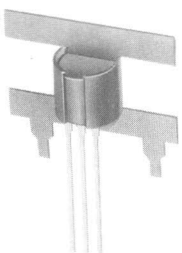
Spade Series — Single Mount



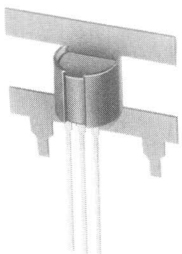
R097B5



R097B18



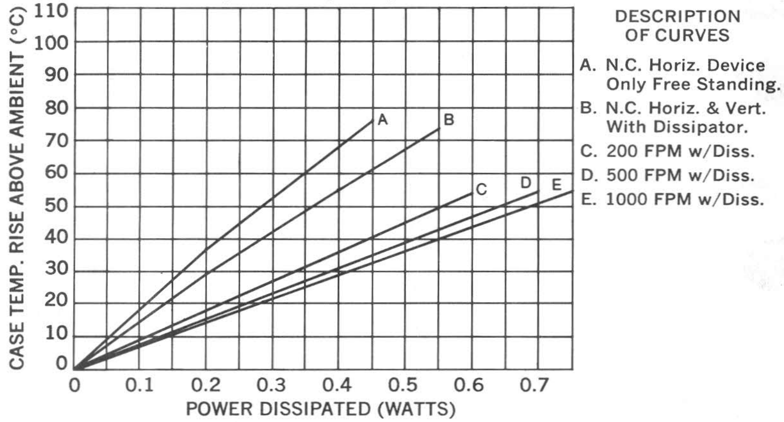
R20B-1



R20DB-1

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

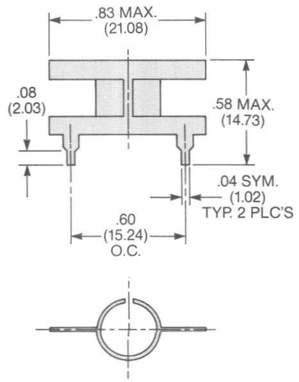
R20D-1B w/MPS-A06 (TO-92) TRANSISTOR



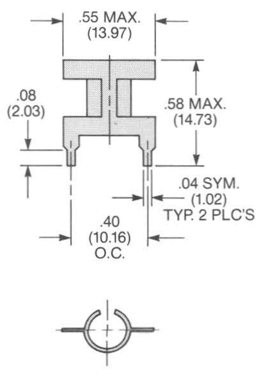
• Derate 9.0 °C/watt for unplated part in natural convection only.

Ordering Information

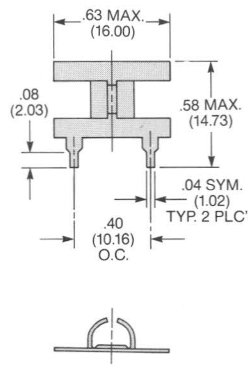
IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Coating	Black Cadmium			
R097B5U	R097B5CB	R097B5B	R110a, R97 or TO-5	Brass	0.8
R097B18U	R097B18CB	R097B18B	R110, R97a or TO-18	Brass	0.5
R20B-1U	R20B-1CB	R20B-1B	TO-92 (>.145 thk.)	Brass	0.4
R20DB-1U	R20DB-1CB	R20DB-1B	TO-92 (<.145 thk.)	Brass	0.5
R0975U	R0975CB	R0975B	R110a, R97 or TO-5	Be Cu	0.8
R09718U	R09718CB	R09718B	R110, R97a or TO-18	Be Cu	0.5
R20-1U	R20-1CB	R20-1B	TO-92 (>.145 thk.)	Be Cu	0.4
R20D-1U	R20D-1CB	R20D-1B	TO-92 (<.145 thk.)	Be Cu	0.5



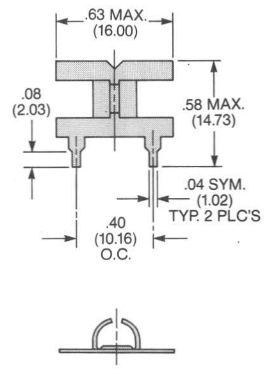
R097B5



R097B18

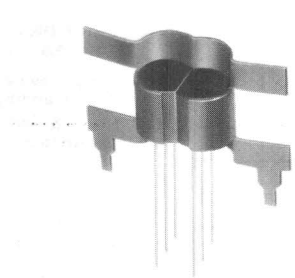


R20B-1

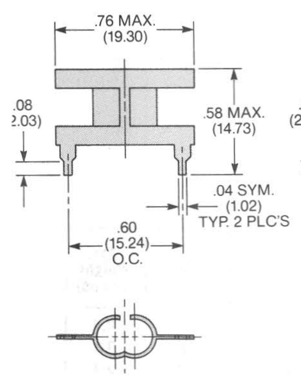


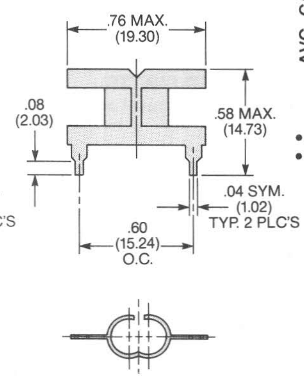
R20DB-1

Spade Series — Dual Mount

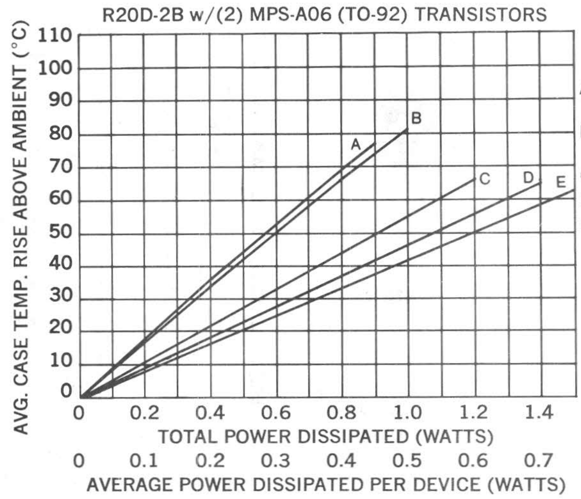


R20B-2 R20DB-2





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Free Standing.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Derate 9.0 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2.5°C at equivalent power levels.

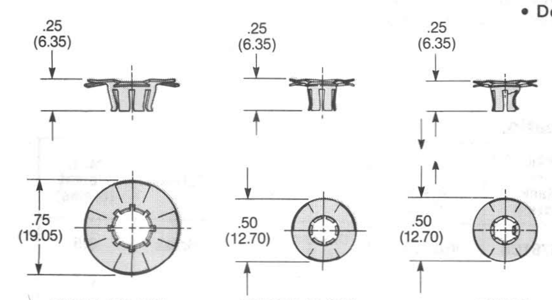
Ordering Information

IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Coating	Black Cadmium			
R20B-2U	R20B-2CB	R20B-2B	Two TO-92s (>.145 thk.)	Brass	0.7
R20DB-2U	R20DB-2CB	R20DB-2B	Two TO-92s (<.145 thk.)	Brass	0.7
R20-2U	R20-2CB	R20-2B	Two TO-92s (>.145 thk.)	Be Cu	0.7
R20D-2U	R20D-2CB	R20D-2B	Two TO-92s (<.145 thk.)	Be Cu	0.7

Fan Top Series

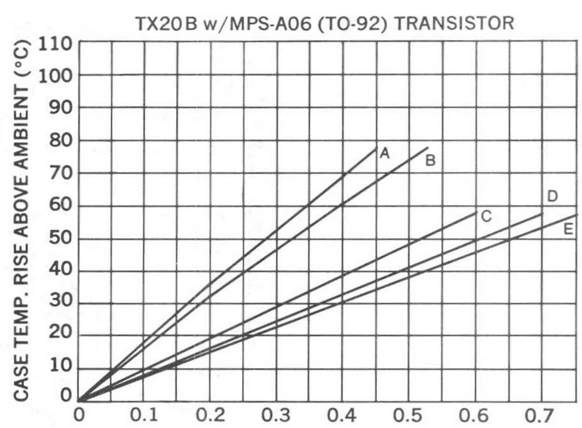
TXCF-032-025

TXCF-019-025 TXC20



TXCF-032-025 TXCF-019-025 TXC20

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Free Standing.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

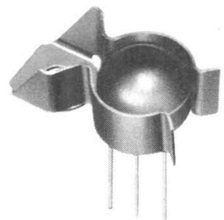
- Derate 9.0 °C/watt for unplated part in natural convection only.

Ordering Information

IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Coating	Black Cadmium			
TXCF-019-025U	TXCF-019-025CB	TXCF-019-025B	R110 or R97a	Brass	0.5
TXCF-032-025U	TXCF-032-025CB	TXCF-032-025B	R110a or R97	Brass	1.2
TXC20U	TXC20CB	TXC20B	TO-92	Brass	0.5
TXBF-019-025U	TXBF-019-025CB	TXBF-019-025B	R110 or R97a	Be Cu	0.5
TXBF-032-025U	TXBF-032-025CB	TXBF-032-025B	R110a or R97	Be Cu	1.2
TX20U	TX20CB	TX20B	TO-92	Be Cu	0.5

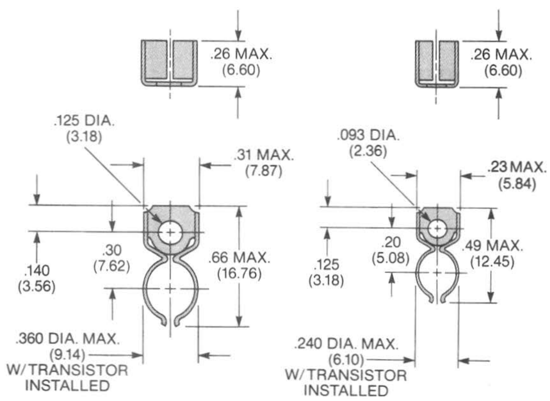
HEAT DISSIPATORS FOR PLASTIC CASE, LEAD-MOUNTED SEMICONDUCTORS

Clip Series



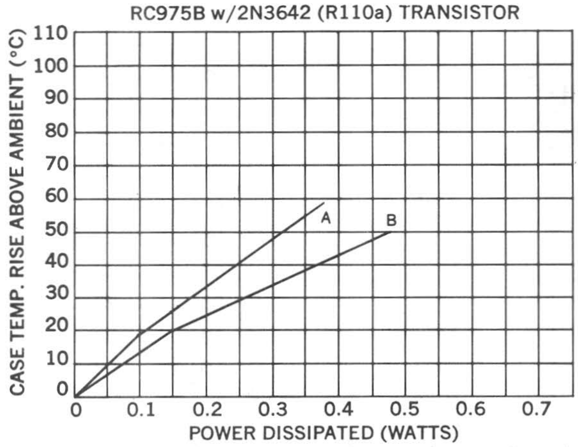
RC97B5

RC97B18



RC97B5 RC97B18

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Free Standing.

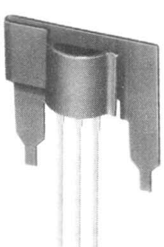
B. N.C. Horiz. & Vert. With Dissipator.

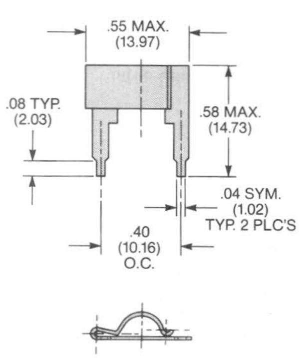
• Derate 5.0 °C/watt for unplated part in natural convection only.

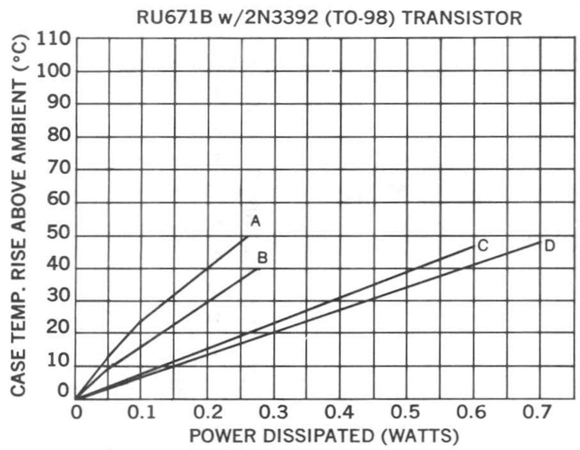
Ordering Information

IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Coating	Black Cadmium			
RC97B5U	RC97B5CB	RC97B5B	One R97, R110a or TO-5	Brass	0.4
RC97B18U	RC97B18CB	RC97B18B	One R97a, R110 or TO-18	Brass	0.3
RC975U	RC975CB	RC975B	One R97, R110a or TO-5	Be Cu	0.4
RC9718U	RC9718CB	RC9718B	One R97a, R110 or TO-18	Be Cu	0.3

Universal D-Series — Single Mount







DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Free Standing.

B. N.C. Horiz. & Vert. With Dissipator.

C. 500 FPM w/Diss.

D. 1000 FPM w/Diss.

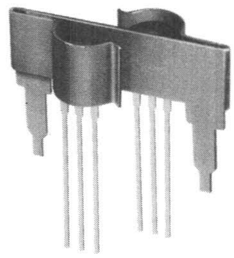
• Derate 8.0 °C/watt for unplated part in natural convection only.

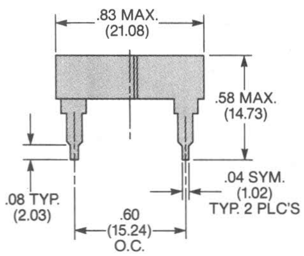
Ordering Information

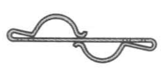
IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Coating	Black Cadmium			
RU67B1U	RU67B1CB	RU67B1B	One D-case plastic trans.	Brass	0.5
RU671U	RU671CB	RU671B	One D-case plastic trans.	Be Cu	0.5

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

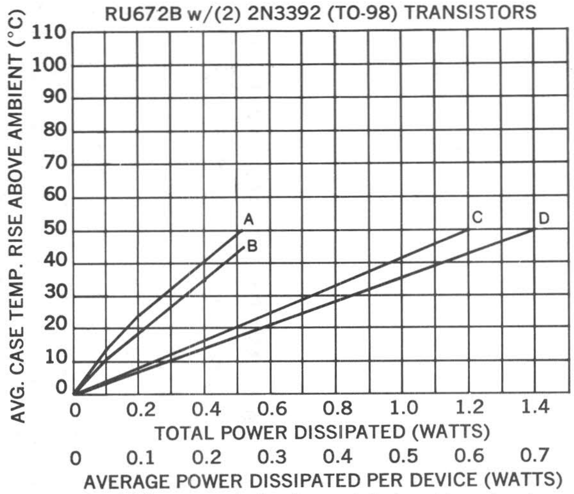
Universal D-Series — Dual Mount







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

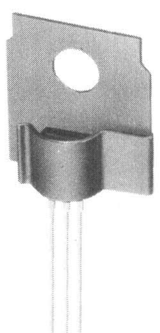
A. N.C. Horiz. Device Only Free Standing.
B. N.C. Horiz. & Vert. With Dissipator.
C. 500 FPM w/Diss.
D. 1000 FPM w/Diss.

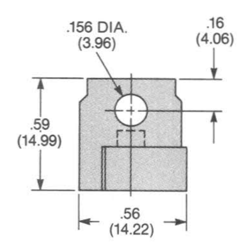
- Derate 8.0 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

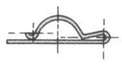
Ordering Information

IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Coating	Black Cadmium			
RU67B2U	RU67B2CB	RU67B2B	Two D-case plastic trans.	Brass	0.6
RU672U	RU672CB	RU672B	Two D-case plastic trans.	Be Cu	0.6

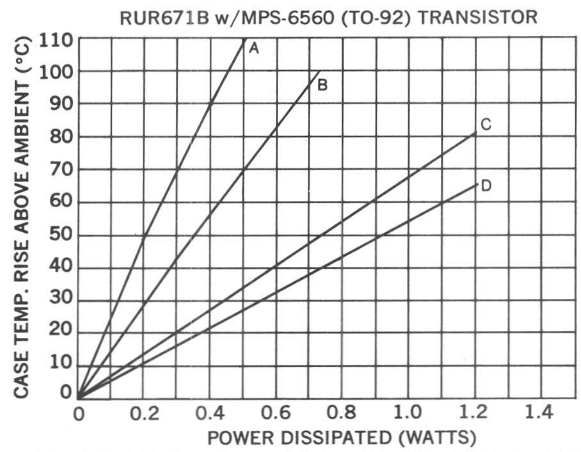
Freestanding D-Series — Single Mount







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Free Standing.
B. N.C. Horiz. & Vert. With Dissipator.
C. 500 FPM w/Diss.
D. 1000 FPM w/Diss.

- Derate 10.0 °C/watt for unplated part in natural convection only.

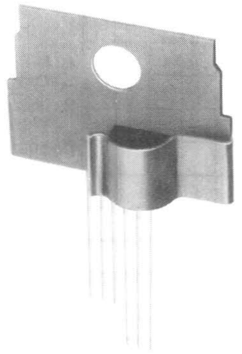
Ordering Information

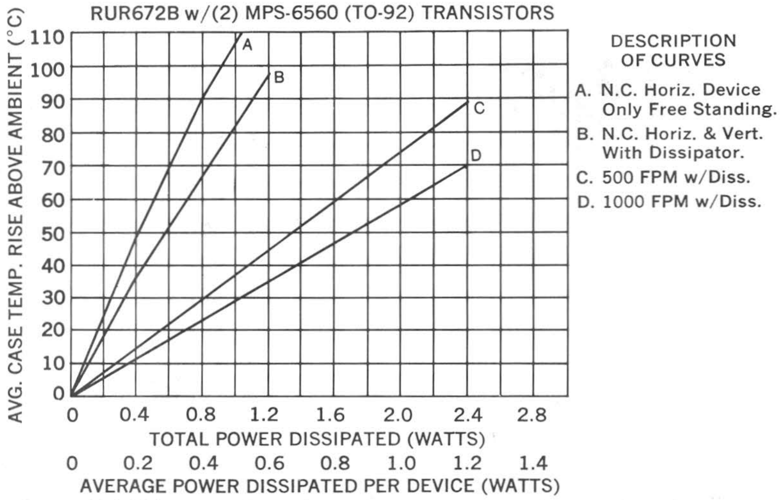
IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Coating	Black Cadmium			
RUR67B1-U	RUR67B1CB	RUR67B1B	One D-case plastic trans.	Brass	0.8
RUR67B1-2U*	RUR67B1-2CB*	RUR67B1-2B*	One D-case plastic trans.	Brass	0.8
RUR671U	RUR671CB	RUR671B	One D-case plastic trans.	Be Cu	0.8
RUR671-2U*	RUR671-2CB*	RUR671-2B*	One D-case plastic trans.	Be Cu	0.8

*Part features positive stop.

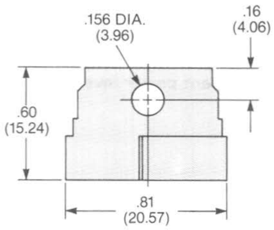
HEAT DISSIPATORS FOR DIPS, FLATPACKS, AND MICROCIRCUITS

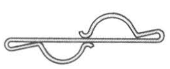
Freestanding D-Series — Dual Mount





- Derate 10.0 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.





Ordering Information

IERC PART NO.			Semiconductor Accommodated	Material	Max. Weight (Grams)
Unplated	Black Coating	Black Cadmium			
RUR67B2U	RUR67B2CB	RUR67B2B	Two D-case plastic trans.	Brass	1.2
RUR672U	RUR672CB	RUR672B	Two D-case plastic trans.	Be Cu	1.2

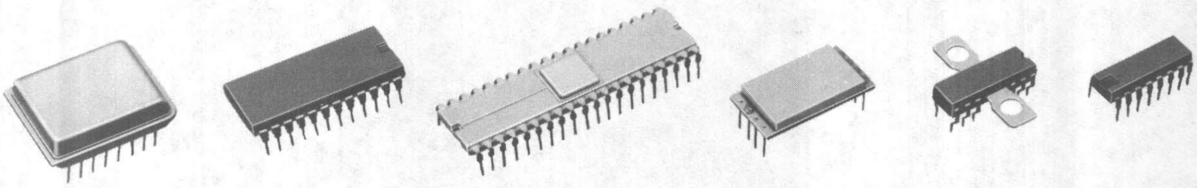
Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

SECTION 5

HEAT DISSIPATORS FOR DIPS, FLATPACKS, AND MICROCIRCUITS

SECTION 5

HEAT DISSIPATORS FOR DIPS, FLATPACKS, AND MICROCIRCUITS



Determining the appropriate dissipator for DIPs, flatpacks and microcircuits (TO-116, MPUs, microcircuits, and sealed cans) can be readily accomplished using the two indices illustrated below.

The index on the left is arranged according to increasing power dissipation capability (decreasing thermal resistance), while the index on the right lists dissipators in order of board area requirements and dissipator height.

Using the indices, it becomes a simple matter to locate a number of dissipators with similar, desirable thermal specifications; or to compare respective dimensions to determine the specific dissipator suited to your particular packaging requirements.

All thermal resistance data contained in these indices (unless otherwise noted) is based on 60°C case temperature rise above ambient in natural convection, and at 20°C case rise above ambient in forced-air at 1000 fpm air velocity.

It is also important to remember that the thermal resistance values listed in the two indices are given for reference only. They are intended to help the engineer "zero in" on a suitable dissipator and should not be used to predict actual thermal performance.

The IERC dissipators illustrated in this section can solve a wide variety of thermal management problems, when they are chosen carefully. Features and detailed descriptions of the individual dissipators are located in the appropriate areas within the section.

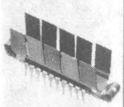
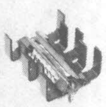
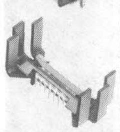
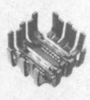
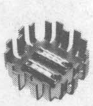
In order to select the proper heat dissipator for a particular application, simply follow the formula outlined below to determine the correct heat dissipator part number.

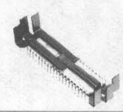
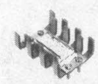
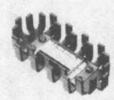
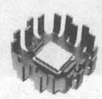
1. Determine maximum anticipated power dissipation.
2. Determine maximum allowable temperature rise by subtracting the maximum ambient temperature (design ambient) from the maximum case temperature you wish to maintain.

Normally the maximum allowable case temperature is determined by subtracting the product of the junction-to-case thermal resistance and the maximum power dissipation from the maximum allowable junction temperature. However, many publications list maximum case temperatures in lieu of maximum junction temperatures and thermal resistance junction-to-case. Hence we will address ourselves to controlling case temperatures keeping in mind that if the information is available junction temperature management is the best approach.

It is frequent practice to hold the case temperature to less than the maximum allowable temperature in order to increase component reliability. For a more

INDEX BY THERMAL RESISTANCE

Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Mounting Envelope LxWxH (inches)	Page
Dissipators for .300" wide DIPs	**Single Mounting**				
	PB2-10	30.3	10.3	1.18 x 1.00 x .31	5-5
	LIC214A1	28.9	9.3	1.80 x .75 x .25	5-6
	PB1-10	27.8	10.2	1.18 x 1.00 x .50	5-5
	LIC214A2	26.3	8.6	1.80 x .75 x .50	5-6
	PEP50AB	23.8	8.2	1.30 x .38 x .64	5-4
	LIC214A3	23.7	8.5	1.80 x .75 x .75	5-7
	LIC214A4	22.2	7.9	1.80 x .75 x 1.00	5-7
	PEP50BB	20.8	7.2	1.70 x .38 x .64	5-4
	**Dual Mounting**				
	UP1-348[2]	14.2	4.6	1.78 x 1.78 x .50	5-8
	UP2-348[2]	12.7	4.3	1.78 x 1.78 x .75	5-8
	UP-348[2]	11.9	4.2	1.78 x 1.78 x 1.00	5-9
	HP1-348[2]	9.1	3.9	2.50 x 2.50 x .90	5-9
	**MP324 Case**				
	LA414B2	18.8	6.4	1.67 x 1.32 x .50	5-10

Heat Dissipator Configuration	Part Series	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Mounting Envelope LxWxH (inches)	Page
MP324 Case (cont.)	LA414B3	15.2	5.7	1.67 x 1.32 x .75	5-10
	LA414B4	13.6	5.4	1.67 x 1.32 x 1.00	5-11
	LA414B5	12.4	5.2	1.67 x 1.32 x 1.25	5-11
Dissipators for .600" wide DIPs	APIC025[1,3]	25.9	7.1	2.00 x .75 x .25	5-12
	APIC050[1,3]	22.9	7.1	2.00 x .75 x .50	5-12
	APIC075[1,3]	22.7	7.1	2.00 x .75 x .75	5-13
Dissipators for Hybrid Microcircuits	LBOC2-60	29.8	18.2	1.47 x 1.12 x .31	5-13
	LBOC2-65	29.8	18.2	1.47 x 1.12 x .31	5-14
	LBOC1-60	25.6	12.9	1.47 x 1.12 x .50	5-14
	LBOC1-65	25.6	12.9	1.47 x 1.12 x .50	5-15
	LBOC2-61	24.4	12.3	2.31 x 1.12 x .31	5-15
	LBOC2-72	20.8	5.6	2.31 x 1.12 x .31	5-16
	LBOC1-61	20.0	8.7	2.31 x 1.12 x .50	5-16
	LBOC1-72	16.7	3.7	2.31 x 1.12 x .50	5-17
	HP1-218	7.1	2.4	2.50 x 2.50 x .90	5-17

Notes: [1] Thermal resistance at 20°C case rise above ambient in natural convection and 5°C case rise above ambient in forced air (1000 fpm).

[2] System thermal resistance (dissipator accommodates two devices): $\theta \text{ system} = \dfrac{\text{Average case rise}}{\text{Total power dissipated}}$

[3] 2.0" minimum overall length — part expands to accommodate 40-pin dual DIP package.

detailed explanation, see "Principles of Thermal Management" in this catalog.

3. Determine allowable thermal resistance from case-to-ambient by dividing allowable temperature rise by the maximum power dissipation (°C/W).
4. Determine whether you wish to mount two or more semiconductors on one sink for thermal matching and space utilization. One dissipator for two semiconductors often uses less space than two heat sinks.
5. Will the dissipator be used in natural convection or forced air — if so, at what velocity? Dissipator efficiency can be greatly increased when forced air is used (See index, this page).
6. Select a dissipator from the thermal resistance table below and turn to page indicated. From the graph of case temperature rise above ambient determine actual case temperature for given power dissipation. You will note that heat dissipator thermal resistance can vary with power level and dissipator temperature. Is this temperature rise acceptable? If not, consult the Thermal Resistance Index to find a dissipator with a slightly lower thermal resistance. If you must maintain a specific board area requirement select a more effective, i.e., taller dissipator from the Index by Board Area and then make your final selection based upon the performance curves supplied for each part in the catalog.
7. From the ordering information select the hole pattern (if applicable) and finish desired. Note that an unplated part will run hotter than a black anodized part in natural convection by the amount given in the rating factors.

Other factors regarding dissipator efficiency and selection parameters are covered in "Principles of Thermal Management."

The following example illustrates this simple procedure:

Problem: To cool a TO-116 case semiconductor that will dissipate .4 watts. From the transistor data sheet we determine that:

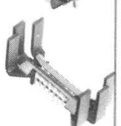
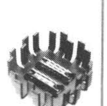
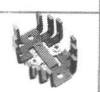
Max. Case Temp. = 70°C

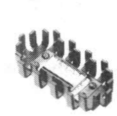
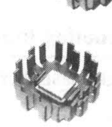
For increased reliability and a safety factor, we set the design case temperature at 60°C. A design ambient of 50°C is set. Therefore, max. allowable temperature rise is 10°C. This makes the max. allowable thermal resistance

$$\frac{10°C}{.4W} = 25\ °C/W.$$

No forced air is available, therefore the design must be for natural convection. In looking down the Index by Thermal Resistance for the .300″ wide DIP packages we quickly see that there are two dissipators which deserve further consideration. The LIC214A4 and the PEP50AB both have thermal resistances close to our design value of 25 °C/watt. Turning to pages 5-5 and 5-6, a quick comparison of the thermal performance and mounting configuration may be made. The LIC214A4 has slightly better thermal performance than the PEP50AB and will fit our design specifications perfectly, having a 10°C/case rise above ambient at .4 watts. The complete part number for a commercial black part is LIC214A4CB, also a DC000080-2B retainer is required with this part to make a complete assembly.

INDEX BY BOARD AREA REQUIREMENTS

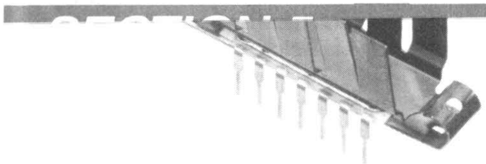
Heat Dissipator Configuration	Part Series	Mounting Envelope LxWxH (inches)	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page
Dissipators for .300″ wide DIPs	Single Mounting				
	PEP50AB	1.30 x .38 x .64	23.8	8.2	5-4
	PEP50BB	1.70 x .38 x .64	20.8	7.2	5-4
	PB2-10	1.18 x 1.00 x .31	30.3	10.3	5-5
	PB1-10	1.18 x 1.00 x .50	27.8	10.2	5-5
	LIC214A1	1.80 x .75 x .25	28.9	9.3	5-6
	LIC214A2	1.80 x .75 x .50	26.3	8.6	5-6
	LIC214A3	1.80 x .75 x .75	23.7	8.5	5-7
	LIC214A4	1.80 x .75 x 1.00	22.2	7.9	5-7
	Dual Mounting				
	UP1-348[2]	1.78 x 1.78 x .50	14.2	4.6	5-8
	UP2-348[2]	1.78 x 1.78 x .75	12.7	4.3	5-8
	UP-348[2]	1.78 x 1.78 x 1.00	11.9	4.2	5-9
	HP1-348[2]	2.50 x 2.50 x .90	9.1	3.9	5-9
	MP324 Case				
	LA414B2	1.67 x 1.32 x .50	18.8	6.4	5-10

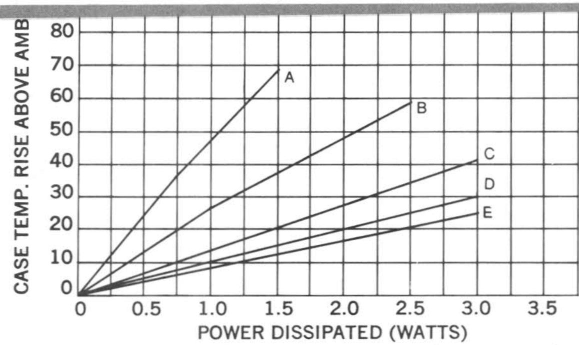
Heat Dissipator Configuration	Part Series	Mounting Envelope LxWxH (inches)	Thermal Resistance Nat. Conv. (°C/W)	Thermal Resistance Forced Air (°C/W)	Page
MP324 Case (cont.)	LA414B3	1.67 x 1.32 x .75	15.2	5.7	5-10
	LA414B4	1.67 x 1.32 x 1.00	13.6	5.4	5-11
	LA414B5	1.67 x 1.32 x 1.25	12.4	5.2	5-11
Dissipators for .600″ wide DIPs	APIC025[1,3]	2.00 x .75 x .25	25.9	7.1	5-12
	APIC050[1,3]	2.00 x .75 x .50	22.9	7.1	5-12
	APIC075[1,3]	2.00 x .75 x .75	22.7	7.1	5-13
Dissipators for Hybrid Microcircuits	LBOC2-60	1.47 x 1.12 x .31	29.8	18.2	5-13
	LBOC1-60	1.47 x 1.12 x .50	25.6	12.9	5-14
	LBOC2-65	1.47 x 1.12 x .31	29.8	18.2	5-14
	LBOC1-65	1.47 x 1.12 x .50	25.6	12.9	5-15
	LBOC2-61	2.31 x 1.12 x .31	24.4	12.3	5-15
	LBOC1-61	2.31 x 1.12 x .50	20.0	8.7	5-16
	LBOC2-72	2.31 x 1.12 x .31	20.8	5.6	5-16
	LBOC1-72	2.31 x 1.12 x .50	16.7	3.7	5-17
	HP1-218	2.50 x 2.50 x .90	7.1	2.4	5-17

Notes: [1] Thermal resistance at 20°C case rise above ambient in natural convection and 5°C case rise above ambient in forced air (1000 fpm).

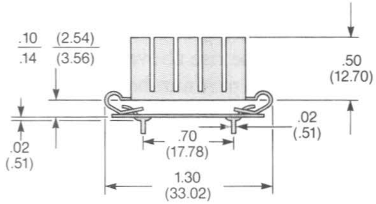
[2] System thermal resistance (dissipator accommodates two devices): θ system $= \frac{\text{Average case rise}}{\text{Total power dissipated}}$

[3] 2.0″ minimum overall length — part expands to accommodate 40-pin dual DIP package.

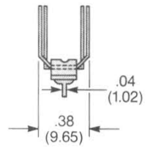




B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.



- Thermal Resistance Case to Sink is 0.5-1.2 °C/W w/Joint Compound.
- Derate 3.0 °C/watt for unplated part in natural convection only.

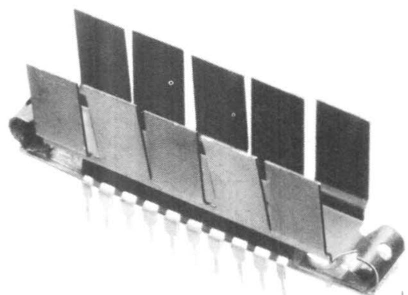


Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

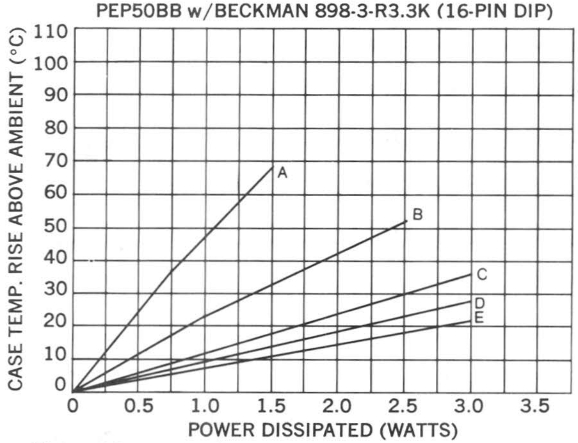
Ordering Information

IERC ASSEMBLY PART NO.	Component Part No.	Finish	Material	Semiconductor Accommodated	Max. Weight (Grams)
PEP50AB	Dissipator — PED50AB	Black Cadmium Plate	Be Cu	Single DIP with up to 16 pins	2.6
	Conduction Bar — PEC1AT/0120	Solder Plate	Cu		

PEP50BB

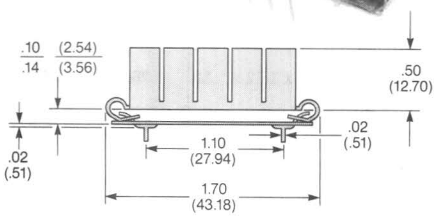


PEP50BB w/BECKMAN 898-3-R3.3K (16-PIN DIP)

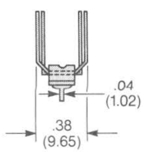


DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.



- Thermal Resistance Case to Sink is 0.5-1.2 °C/W w/Joint Compound.
- Derate 3.0 °C/watt for unplated part in natural convection only.



Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Ordering Information

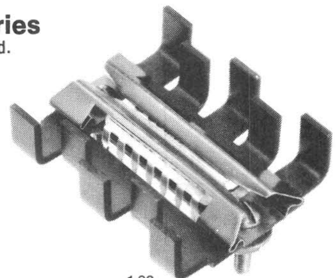
IERC ASSEMBLY PART NO.	Component Part No.	Finish	Material	Semiconductor Accommodated	Max. Weight (Grams)
PEP50BB	Dissipator — PED50BB	Black Cadmium Plate	Be Cu	.300" wide DIP with up to 24 pins	3.7
	Conduction Bar — PEC1BT/0160	Solder Plate	Cu		

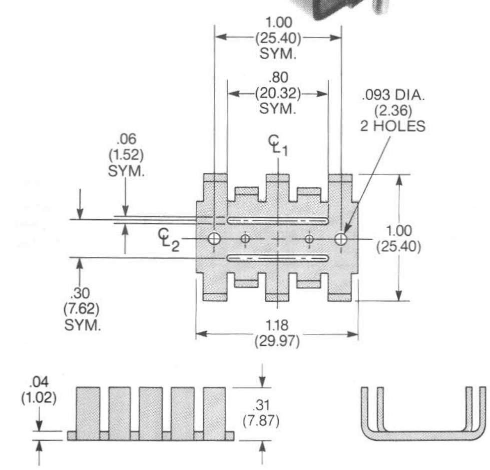
Heat dissipators/retainers for DIP ICs

- Provides heat dissipation for 14- and 16-pin DIP IC devices with body lengths less than .770″.
- Power dissipation can be increased by a minimum of 75% in natural convection with no increase in junction temperature.
- UP and HP Series dissipators are particularly suitable for thermal matching of power DIPs.
- Retainers can be used independently as excellent retention devices.
- Retainer material: beryllium copper.

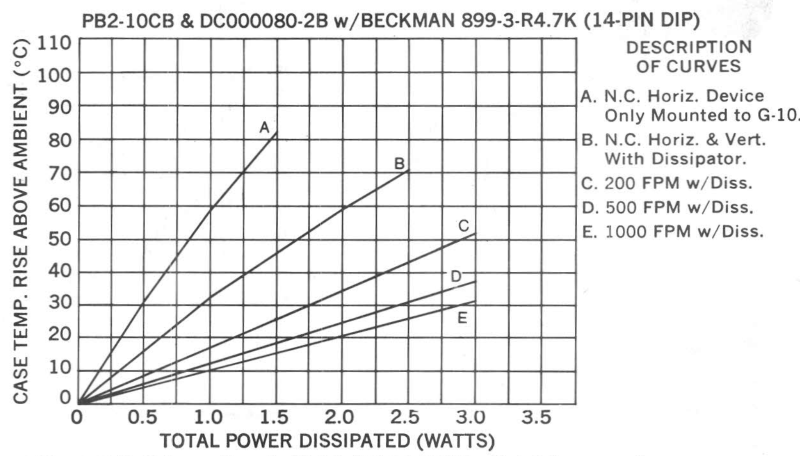
PB2-10 Series

(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 3.5-4.1 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 2.8 °C/watt for Insulube® part in natural convection only.

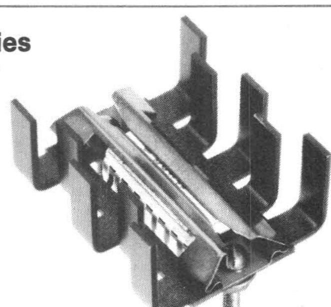
Ordering Information

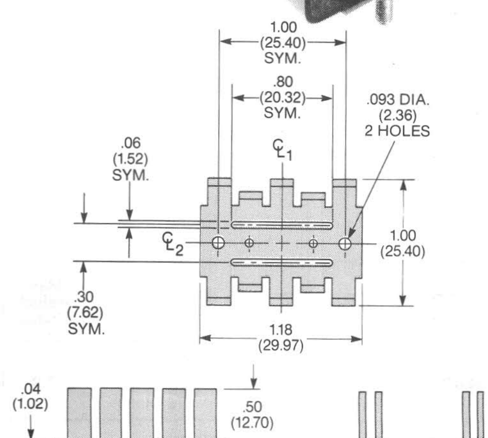
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
PB2-10U	PB2-10CB	PB2-10B	PB2-10	.300″ wide DIPs with up to 16 leads	2.5

Note: DC000080-2B retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawings.

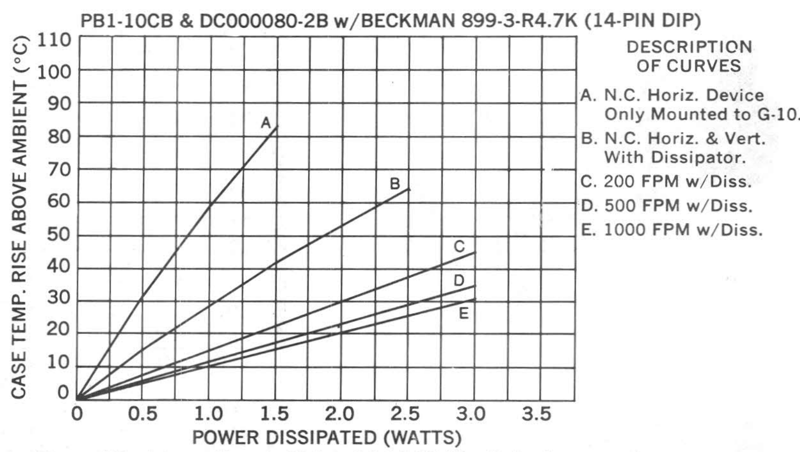
PB1-10 Series

(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 3.5-4.1 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 2.8 °C/watt for Insulube® part in natural convection only.

Ordering Information

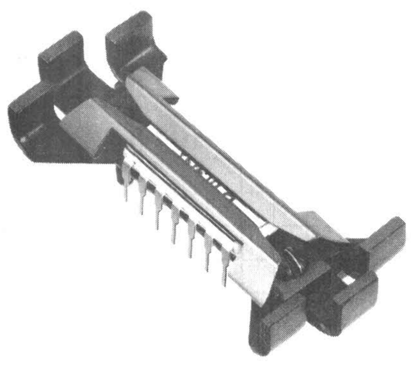
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
PB1-10U	PB1-10CB	PB1-10B	PB1-10	.300″ wide DIPs with up to 16 leads	3.0

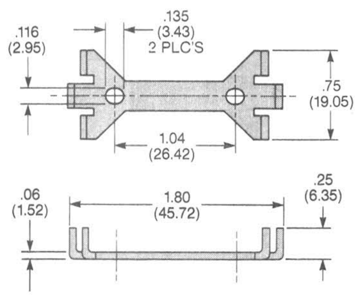
Note: DC000080-2B retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawings.

HEAT DISSIPATORS FOR DIPS, FLATPACKS, AND MICROCIRCUITS

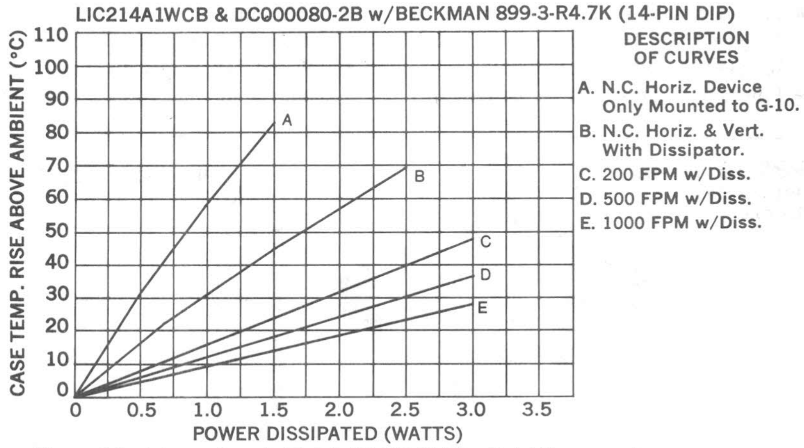
LIC214A1 Series

(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 3.1-3.9 °C/W w/Joint Compound.
- Derate 0.7 °C/watt for unplated part in natural convection only.
- Derate 2.8 °C/watt for Insulube® part in natural convection only.

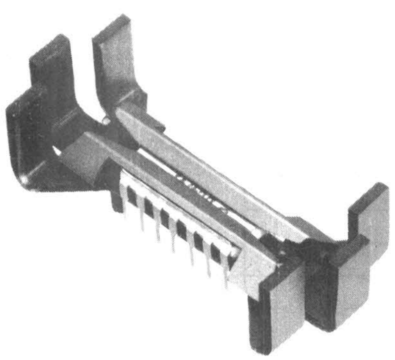
Ordering Information

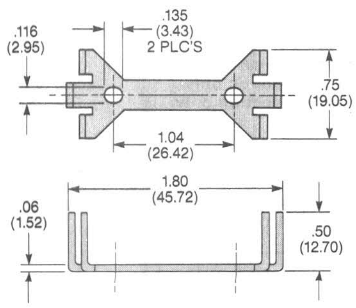
IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Mil. Black Anodize*	Insulube 448®		
LIC214A1U	LIC214A1WCB	LIC214A1WB	LIC214A1B	LIC214A1	All .300" wide DIPs (less than .770" long)	2.2

*Dissipator edges adjacent to the DIP pins are coated with an insulating compound.
Note: DC000080-2 retainer is required and must be ordered separately. See page 5-18 for ordering information and dimensional drawings.

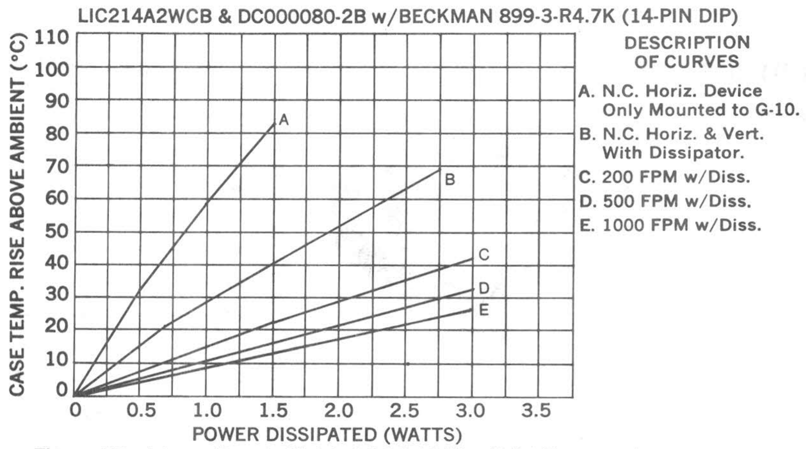
LIC214A2 Series

(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 3.1-3.9 °C/W w/Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 2.8 °C/watt for Insulube® part in natural convection only.

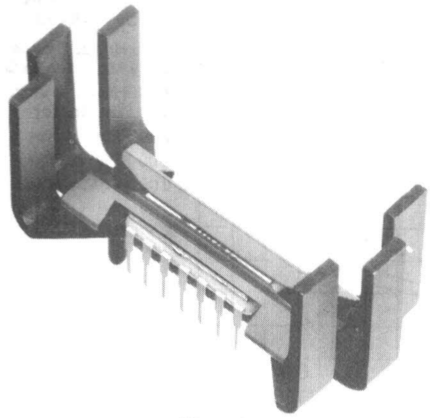
Ordering Information

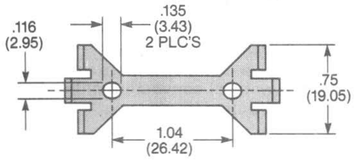
IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Mil. Black Anodize*	Insulube 448®		
LIC214A2U	LIC214A2WCB	LIC214A2WB	LIC214A2B	LIC214A2	All .300" wide DIPs (less than .770" long)	2.9

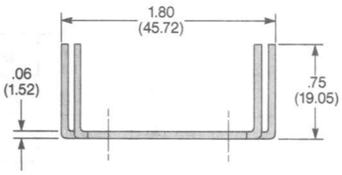
*Dissipator edges adjacent to the DIP pins are coated with an insulating compound.
Note: DC000080-2 retainer is required and must be ordered separately. See page 5-18 for ordering information and dimensional drawings.

LIC214A3 Series

(Retainer required. See note.)

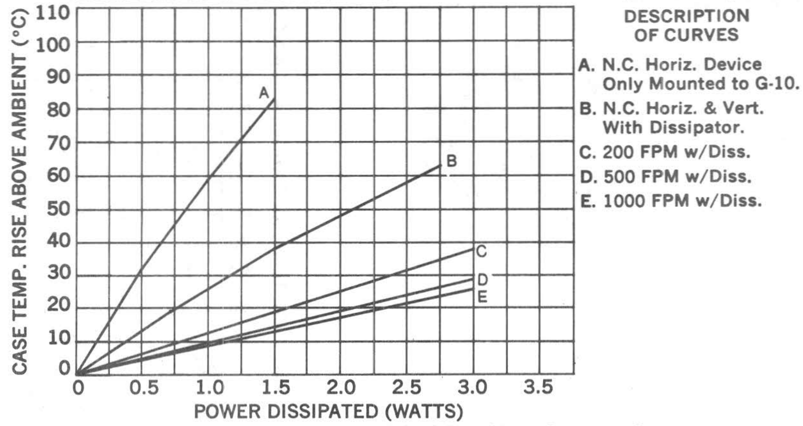






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LIC214A3WCB & DC000080-2B w/BECKMAN 899-3-R4.7K (14-PIN DIP)



- Thermal Resistance Case to Sink is 3.1-3.9 °C/W w/Joint Compound.
- Derate 0.9 °C/watt for unplated part in natural convection only.
- Derate 2.8 °C/watt for Insulube® part in natural convection only.

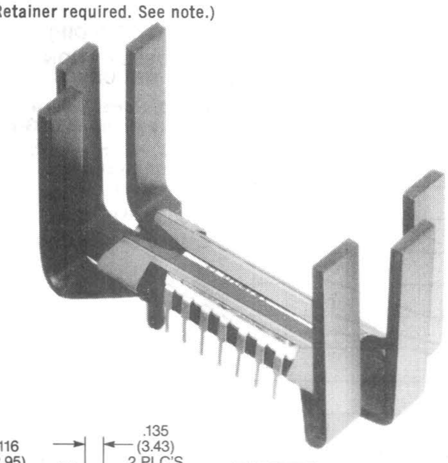
Ordering Information

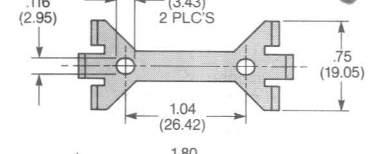
IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Mil. Black Anodize*	Insulube 448®		
LIC214A3U	LIC214A3WCB	LIC214A3WB	LIC214A3B	LIC214A3	All .300" wide DIPs (less than .770" long)	3.5

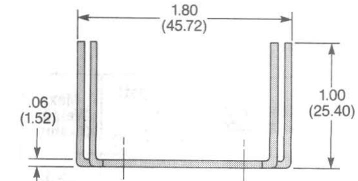
*Dissipator edges adjacent to the DIP pins are coated with an insulating compound.
Note: DC000080-2 retainer is required and must be ordered separately. See page 5-18 for ordering information and dimensional drawings.

LIC214A4 Series

(Retainer required. See note.)

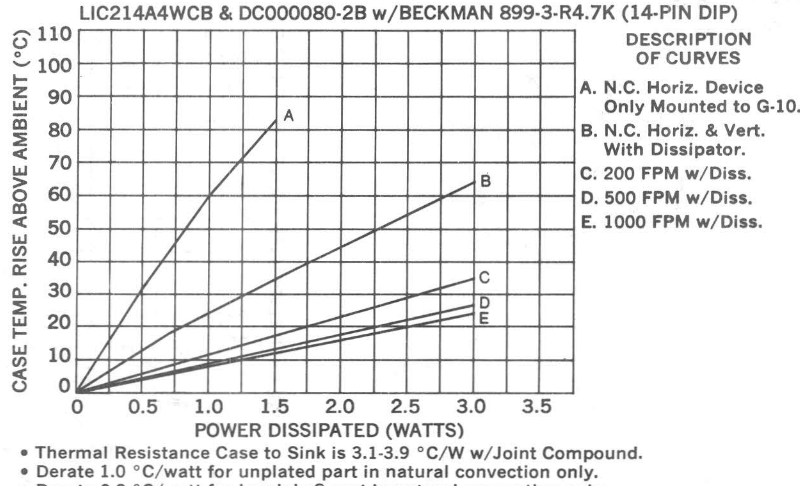






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LIC214A4WCB & DC000080-2B w/BECKMAN 899-3-R4.7K (14-PIN DIP)



- Thermal Resistance Case to Sink is 3.1-3.9 °C/W w/Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 2.8 °C/watt for Insulube® part in natural convection only.

Ordering Information

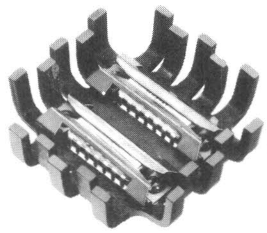
IERC PART NO.					Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Mil. Black Anodize*	Insulube 448®		
LIC214A4U	LIC214A4WCB	LIC214A4WB	LIC214A4B	LIC214A4	All .300" wide DIPs (less than .770" long)	4.1

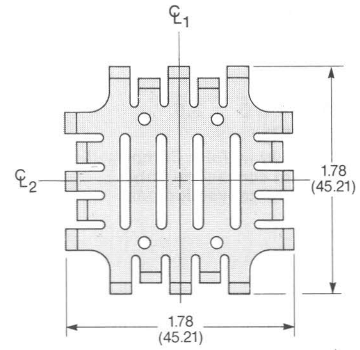
*Dissipator edges adjacent to the DIP pins are coated with an insulating compound.
Note: DC000080-2 retainer is required and must be ordered separately. See page 5-18 for ordering information and dimensional drawings.

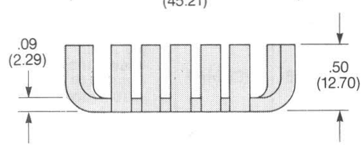
HEAT DISSIPATORS FOR DIPS, FLATPACKS, AND MICROCIRCUITS

UP1-348 Series

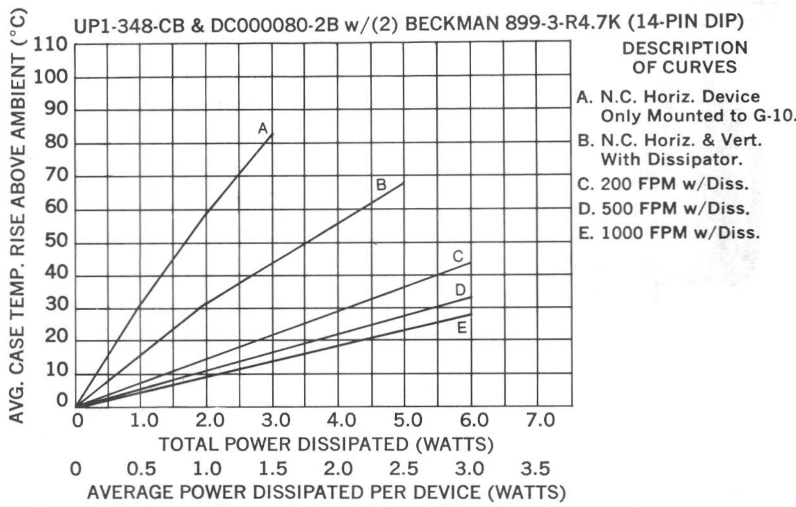
(Retainer required. See note.)







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 4.0-5.4 °C/W w/Joint Compound.
- Derate 2.8 °C/watt per device for Insulube® part in natural convection only.
- Derate 0.5 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

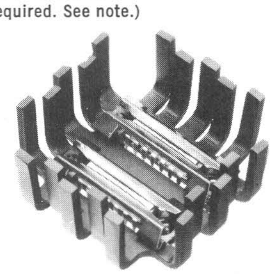
Ordering Information

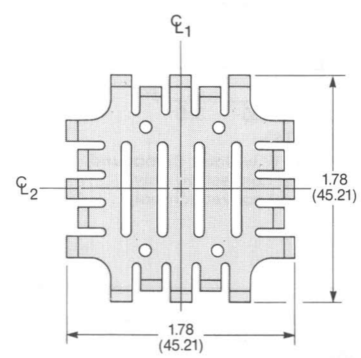
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
UP1-348-U	UP1-348-CB	UP1-348-B	UP1-348	One or two 14- or 16-pin DIPs	1	15.5

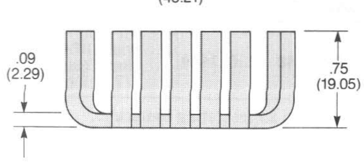
Note: DC000080-2 retainer is required and must be ordered separately. See page 5-18 for ordering information and dimensional drawings.

UP2-348 Series

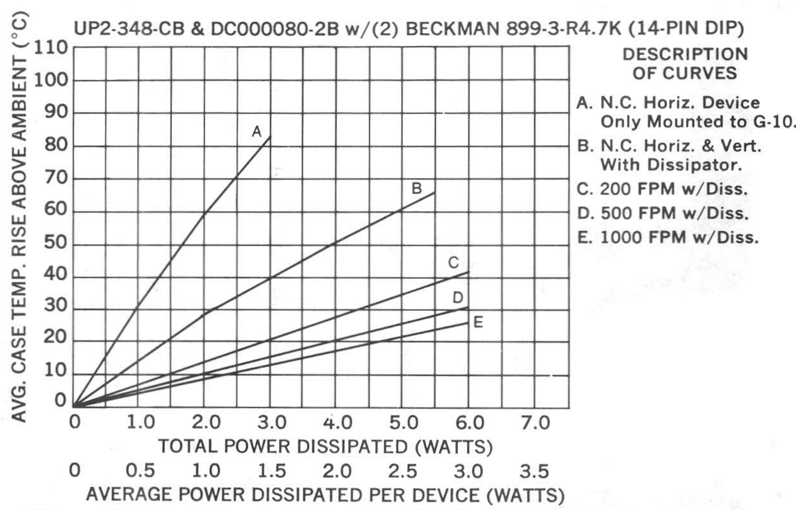
(Retainer required. See note.)







Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 4.0-5.4 °C/W w/Joint Compound.
- Derate 2.8 °C/watt per device for Insulube® part in natural convection only.
- Derate 0.6 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

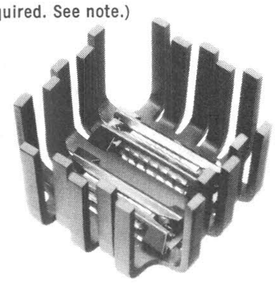
Ordering Information

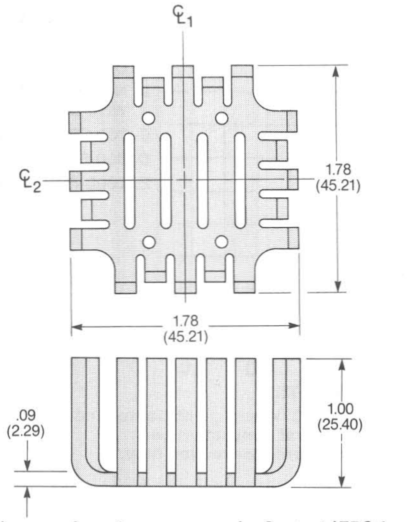
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
UP2-348-U	UP2-348-CB	UP2-348-B	UP2-348	One or two 14- or 16-pin DIPs	1	19.1

Note: DC000080-2 retainer is required and must be ordered separately. See page 5-18 for ordering information and dimensional drawings.

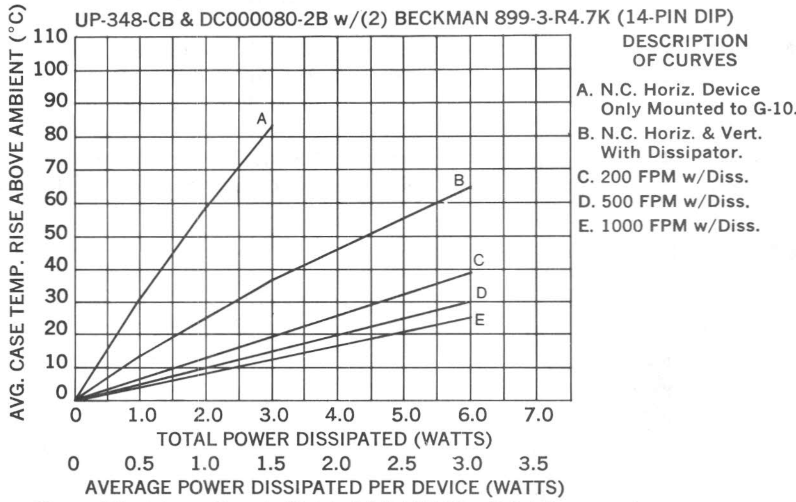
UP-348 Series

(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 4.0-5.4 °C/W w/Joint Compound.
- Derate 2.8 °C/watt per device for Insulube® part in natural convection only.
- Derate 0.6 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

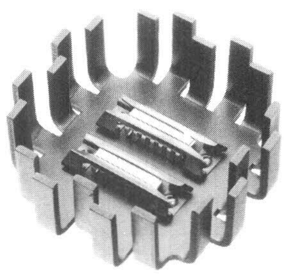
Ordering Information

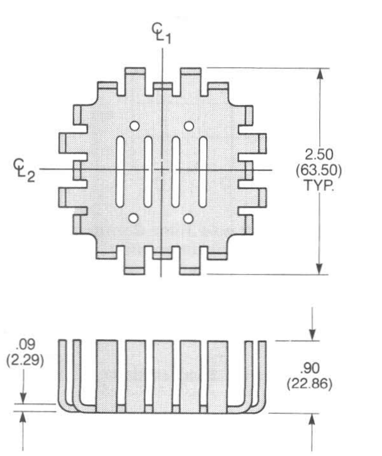
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
UP-348-U	UP-348-CB	UP-348-B	UP-348	One or two 14- or 16-pin DIPs	1	22.5

Note: DC000080-2 retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawings.

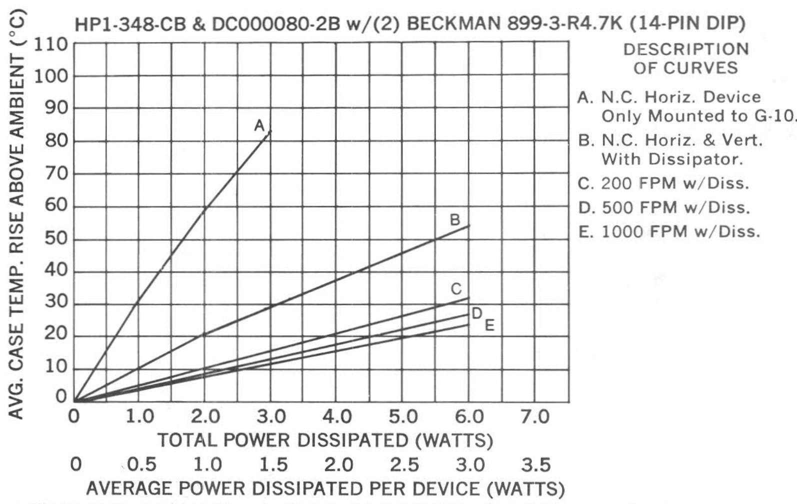
HP1-348 Series

(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Thermal Resistance Case to Sink is 4.0-5.4 °C/W w/Joint Compound.
- Derate 2.8 °C/watt per device for Insulube® part in natural convection only.
- Derate 0.8 °C/watt per device for unplated part in natural convection only.
- Case Temperatures Match Within 2°C at equivalent power levels.

Ordering Information

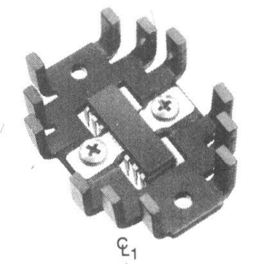
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
HP1-348-U	HP1-348-CB	HP1-348-B	HP1-348	One or two 14- or 16-pin DIPs	1	35.0

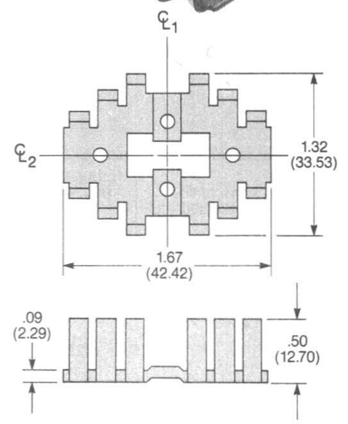
Note: DC000080-2 retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawings.

Heat dissipators for MP324 DIPs

- Allows power increases of 400% in natural convection, 1000% in forced-air modes.
- These LA "limited area" dissipators are designed to fit audio amplifiers and operational amplifiers in the popular MP324 and similar case styles.
- Anti-rotation holes allow the dissipator to be firmly attached to the PC board exclusive of the amplifier mounting holes; as a result the IC is replaced without having to remove the dissipator from the board.
- An embossed area allows the DIP to be contacted at the proper board height and establishes full contact with the "wings" for maximum heat transfer.

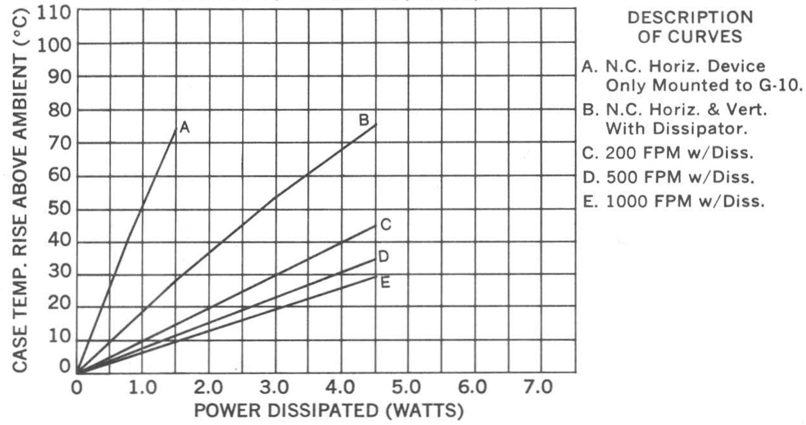
LA414B2 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LA414B2CB w/TBA-810-AS (MP324) IC

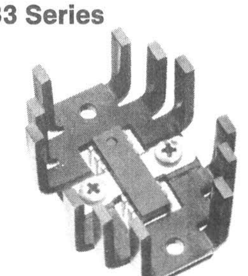


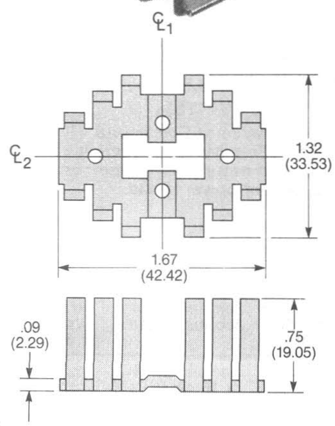
- Thermal Resistance Case to Sink is 2.0-2.2 °C/W w/o Joint Compound.
- Derate 0.4 °C/watt for unplated part in natural convection only.
- Derate 4.8 °C/watt for Insulube® part in natural convection only.

Ordering Information

IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
LA414B2U	LA414B2CB	LA414B2B	LA414B2	One MP324 Amplifier or similar device	2	8.7

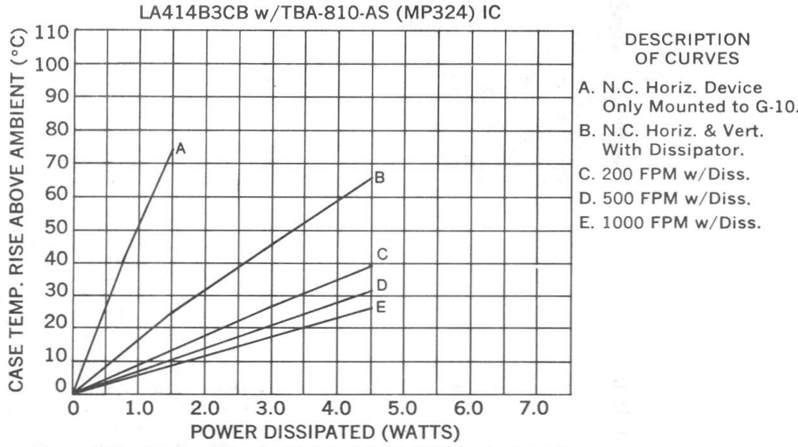
LA414B3 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LA414B3CB w/TBA-810-AS (MP324) IC

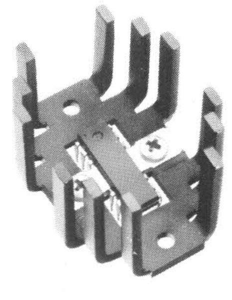


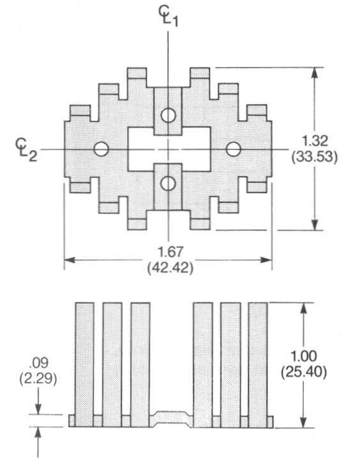
- Thermal Resistance Case to Sink is 2.0-2.2 °C/W w/o Joint Compound.
- Derate 0.5 °C/watt for unplated part in natural convection only.
- Derate 4.8 °C/watt for Insulube® part in natural convection only.

Ordering Information

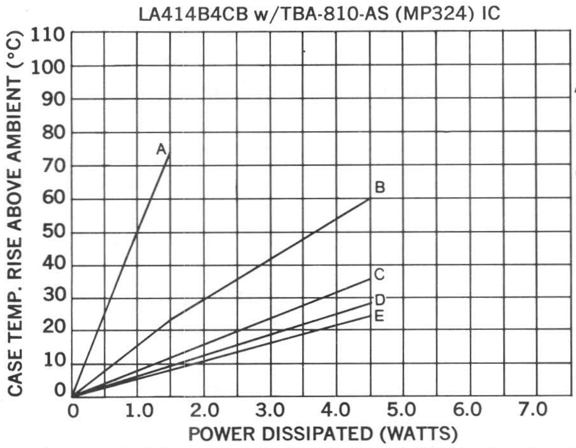
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
LA414B3U	LA414B3CB	LA414B3B	LA414B3	One MP324 Amplifier or similar device	2	10.8

LA414B4 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

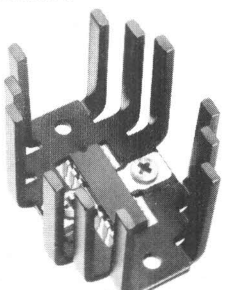
A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

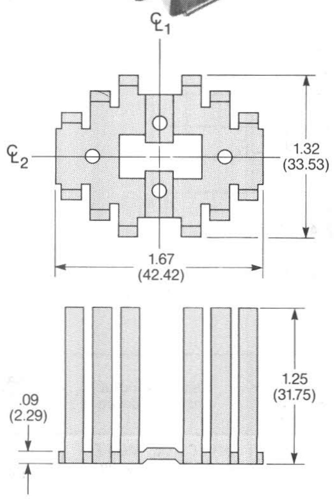
- Thermal Resistance Case to Sink is 2.0-2.2 °C/W w/o Joint Compound.
- Derate 0.5 °C/watt for unplated part in natural convection only.
- Derate 4.8 °C/watt for Insulube® part in natural convection only.

Ordering Information

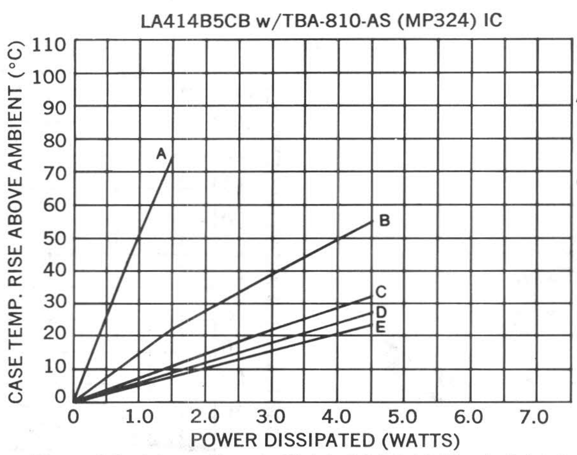
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
LA414B4U	LA414B4CB	LA414B4B	LA414B4	One MP324 Amplifier or similar device	2	12.9

LA414B5 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Thermal Resistance Case to Sink is 2.0-2.2 °C/W w/o Joint Compound.
- Derate 0.5 °C/watt for unplated part in natural convection only.
- Derate 4.8 °C/watt for Insulube® part in natural convection only.

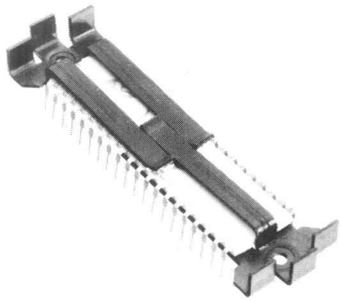
Ordering Information

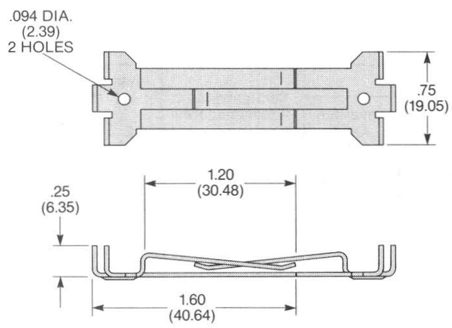
IERC PART NO.				Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
LA414B5U	LA414B5CB	LA414B5B	LA414B5	One MP324 Amplifier or similar device	2	15.1

Micro-Clip heat dissipators for MPUs and double DIPs

- Permits 35% increased power in natural convection with no increase in case temperature and up to 4 times increased power in forced-air modes.
- Needs only 0.6 in. more space than the device.
- Adjusts to fit double DIPs, CMOS, MOSFET, and MPUs packages with 20 to 40 pins. Simplifies stocking.
- Dissipates up to 100% more heat than glued-on devices.
- Spring-finger design permits solid contact with both top and bottom of the package for efficient heat transfer.
- Installation requires only 2 fasteners or a dot of thermally-conductive epoxy.

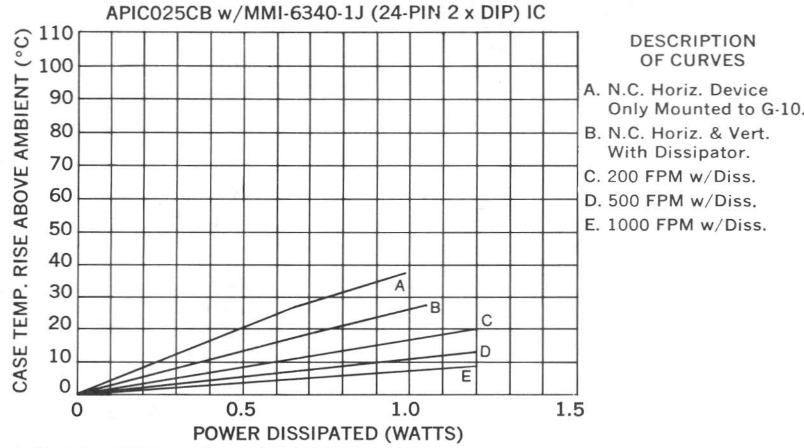
APIC025 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

APIC025CB w/MMI-6340-1J (24-PIN 2 x DIP) IC



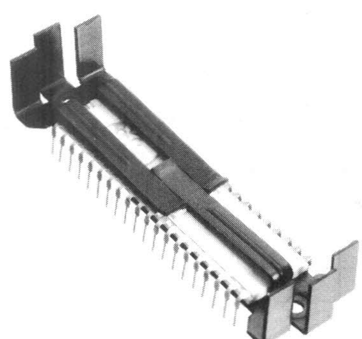
- Test Run Without Thermal Joint Compound.
- Derate 2.0 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

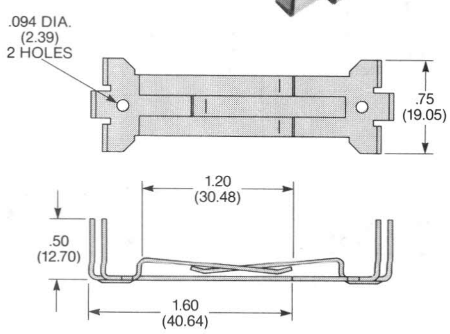
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
APIC025U	APIC025CB	APIC025B	APIC025	DIP, CMOS, MOS-FET and MPU packages with 20 to 40 pins (.600″ lead spacing)	3.0

Note: APIC025 consists of two parts: AIC1025 (with one finger up) and AIC2025 (with two fingers up).

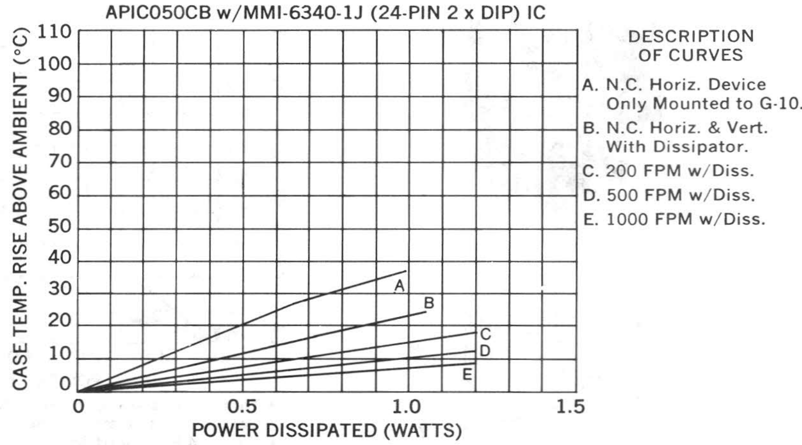
APIC050 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

APIC050CB w/MMI-6340-1J (24-PIN 2 x DIP) IC



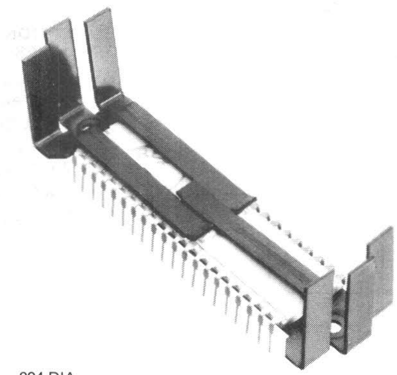
- Test Run Without Thermal Joint Compound.
- Derate 2.5 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

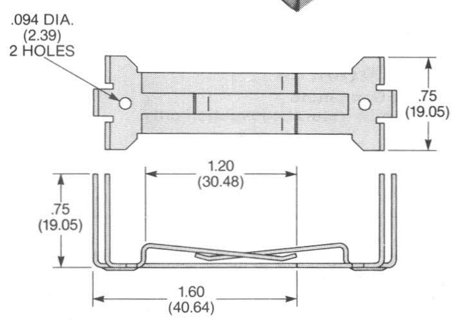
Ordering Information

IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
APIC050U	APIC050CB	APIC050B	APIC050	DIP, CMOS, MOS-FET and MPU packages with 20 to 40 pins (.600″ lead spacing)	3.5

Note: APIC050 consists of two parts: AIC1050 (with one finger up) and AIC2050 (with two fingers up).

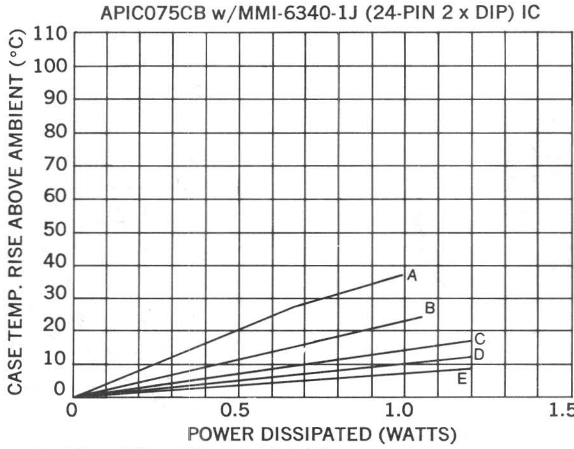
APIC075 Series





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

APIC075CB w/MMI-6340-1J (24-PIN 2 x DIP) IC



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only Mounted to G-10.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Test Run Without Thermal Joint Compound.
- Derate 2.5 °C/watt for unplated part in natural convection only.
- Derate 3.0 °C/watt for Insulube® part in natural convection only.

Ordering Information

IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
APIC075U	APIC075CB	APIC075B	APIC075	DIP, CMOS, MOS-FET and MPU packages with 20 to 40 pins (.600″ lead spacing)	4.0

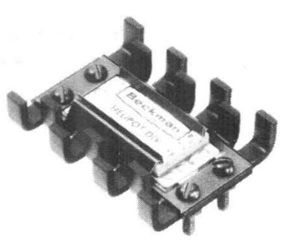
Note: APIC075 consists of two parts: AIC1075 (with one finger up) and AIC2075 (with two fingers up).

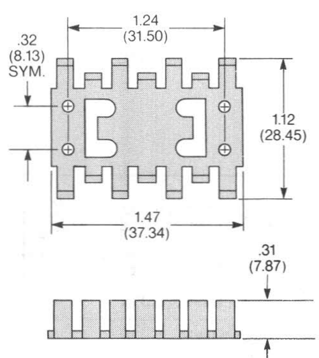
Heat dissipators for microcircuit packages

- LB series dissipators for microcircuit packages are available in several sizes and configurations for selected operating conditions.
- Retainer alone may be used to mount a microcircuit package to a conduction plane.
- DC0510B retainer will retain packages measuring .500″ x 1.00″ x .170″; DC065100B will retain packages measuring .650″ x 1.00″ x .170″. Similar packages as low as .090″ high are also accommodated.
- Retainers DC0510B and DC065100B are made of beryllium copper.

LBOC2-60 Series

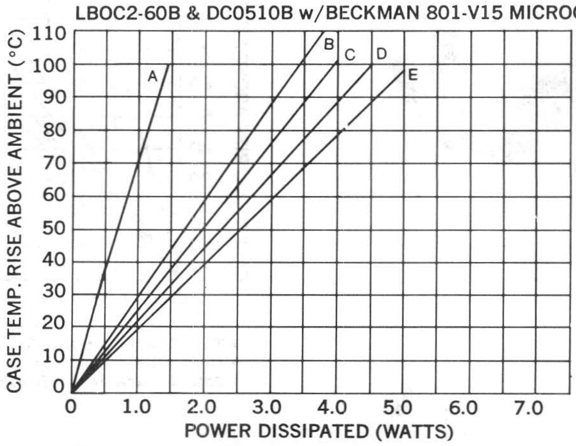
(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LBOC2-60B & DC0510B w/BECKMAN 801-V15 MICROCIRCUIT



DESCRIPTION OF CURVES

A. N.C. Horiz. Device Only in Free Air.
B. N.C. Horiz. & Vert. With Dissipator.
C. 200 FPM w/Diss.
D. 500 FPM w/Diss.
E. 1000 FPM w/Diss.

- Test Conducted With Thermal Joint Compound.
- Derate 1.8 °C/watt for unplated part in natural convection only.

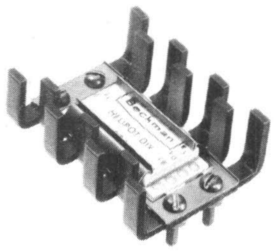
Ordering Information

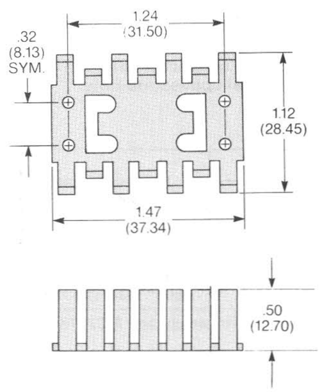
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LBOC2-60U	LBOC2-60CB	LBOC2-60B	LBOC2-60	Microcircuit package (.50″ x 1.0″)	4.8

Note: DC0510 retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawing.

LBOC1-60 Series

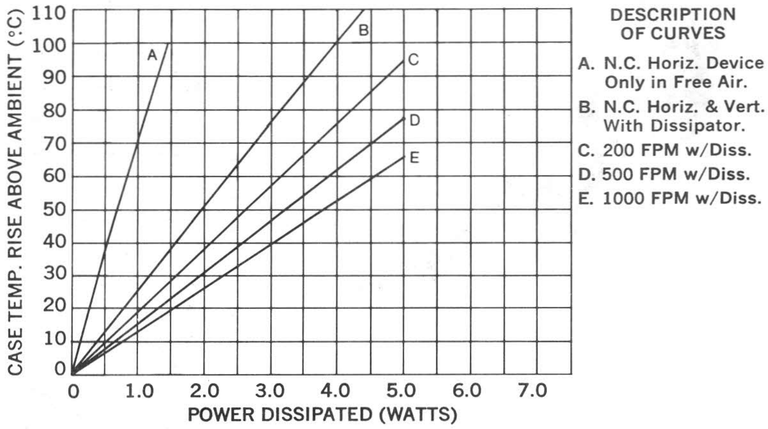
(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LBOC1-60B & DC0510B w/BECKMAN 801-V15 MICROCIRCUIT



- Test Conducted With Thermal Joint Compound.
- Derate 2.0 °C/watt for unplated part in natural convection only.

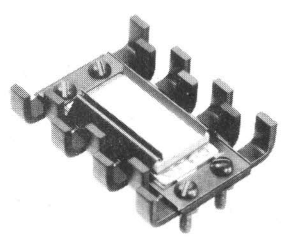
Ordering Information

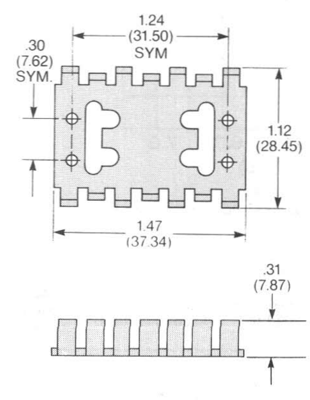
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LBOC1-60U	LBOC1-60CB	LBOC1-60B	LBOC1-60	Microcircuit package (.50" x 1.0")	6.0

Note: DC0510 retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawing.

LBOC2-65 Series

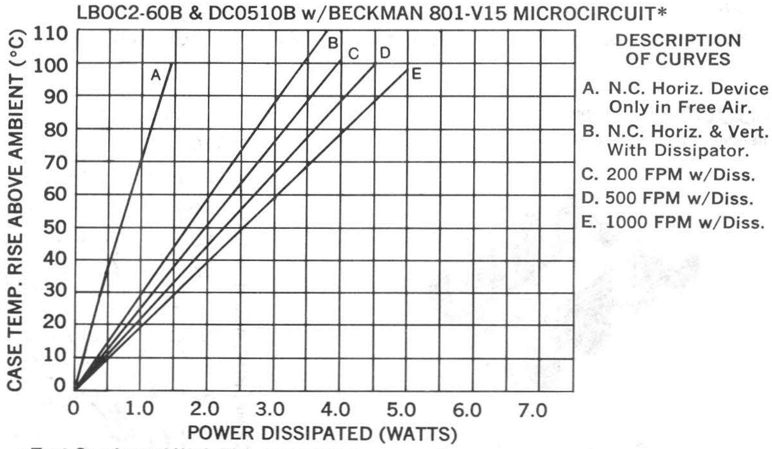
(Retainer required. See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LBOC2-60B & DC0510B w/BECKMAN 801-V15 MICROCIRCUIT*



- Test Conducted With Thermal Joint Compound.
- Derate 1.8 °C/watt for unplated part in natural convection only.

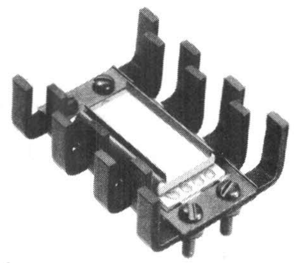
*Data applicable to LBOC2-65B.

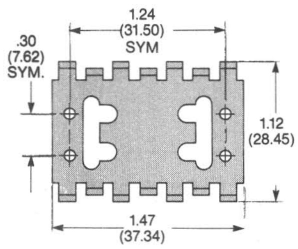
Ordering Information

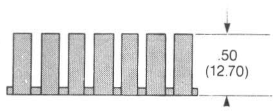
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LBOC2-65U	LBOC2-65CB	LBOC2-65B	LBOC2-65	Microcircuit package (.65" x 1.0")	4.8

Note: DC065100 retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawing.

LBOC1-65 Series
(Retainer required. See note.)

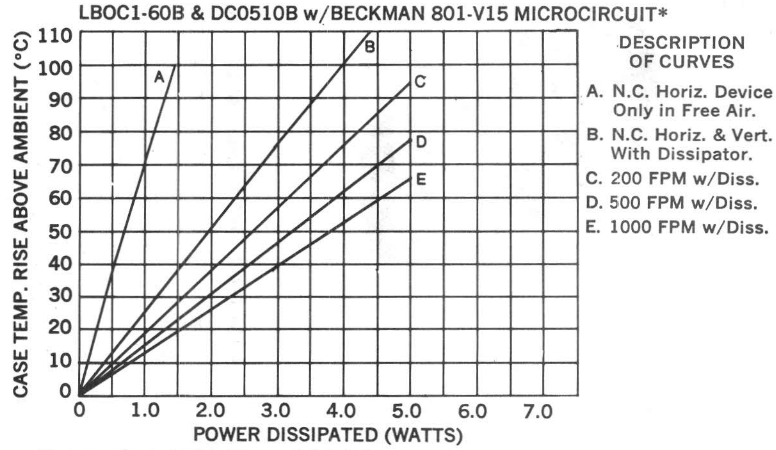






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LBOC1-60B & DC0510B w/BECKMAN 801-V15 MICROCIRCUIT*



- Test Conducted With Thermal Joint Compound.
- Derate 2.0 °C/watt for unplated part in natural convection only.

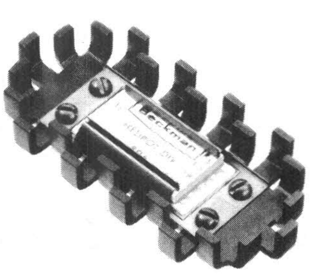
*Data applicable to LBOC1-65B.

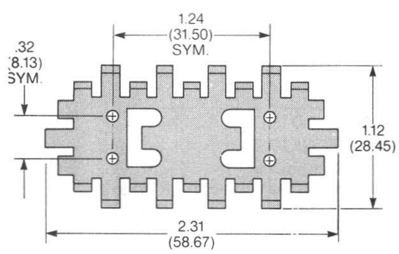
Ordering Information

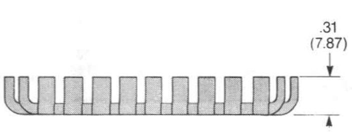
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LBOC1-65U	LBOC1-65CB	LBOC1-65B	LBOC1-65	Microcircuit package (.65" x 1.0")	6.0

Note: DC065100 retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawing.

LBOC2-61 Series
(Retainer required. See note.)

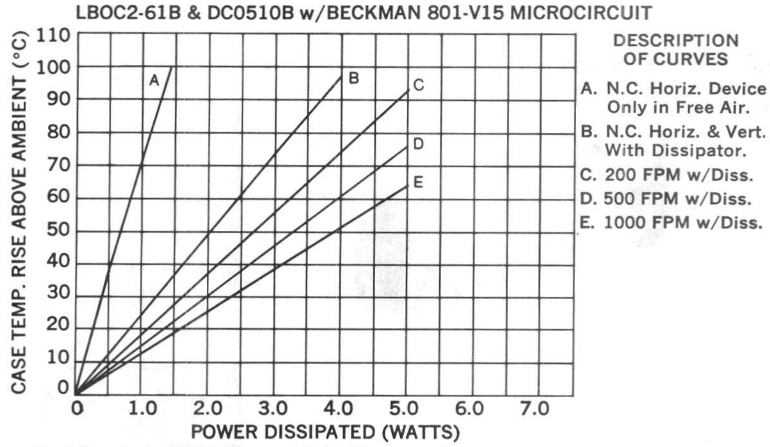






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LBOC2-61B & DC0510B w/BECKMAN 801-V15 MICROCIRCUIT



- Test Conducted With Thermal Joint Compound.
- Derate 2.0 °C/watt for unplated part in natural convection only.

Ordering Information

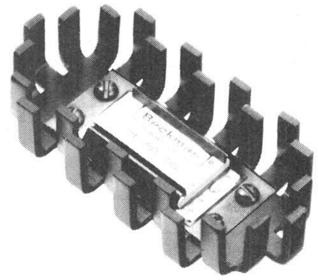
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LBOC2-61U	LBOC2-61CB	LBOC2-61B	LBOC2-61	Microcircuit package (.50" x 1.0")	8.0

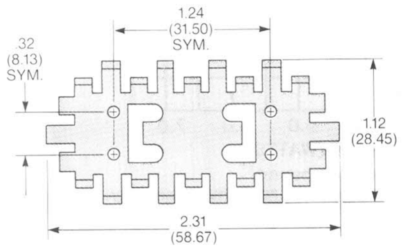
Note: DC0510 retainer is required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawing.

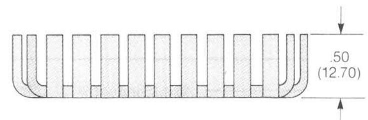
HEAT DISSIPATORS FOR DIPS, FLATPACKS, AND MICROCIRCUITS

LBOC1-61 Series

(Retainer required. See note.)

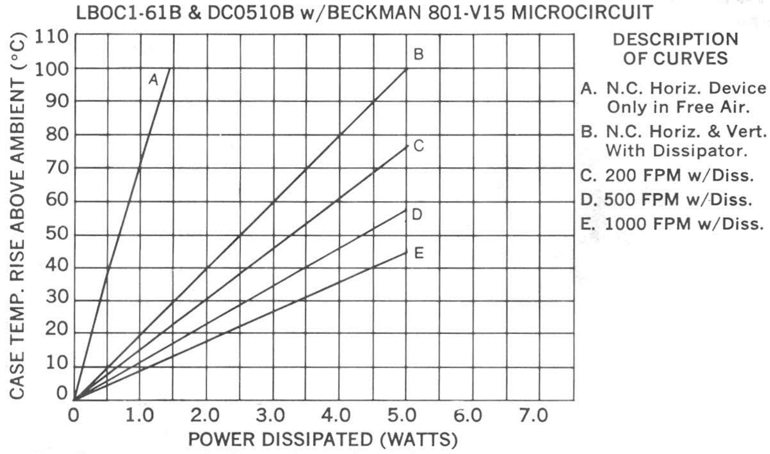






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LBOC1-61B & DC0510B w/BECKMAN 801-V15 MICROCIRCUIT



- Test Conducted With Thermal Joint Compound.
- Derate 2.5 °C/watt for unplated part in natural convection only.

Ordering Information

IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LBOC1-61U	LBOC1-61CB	LBOC1-61B	LBOC1-61	Microcircuit package (.50″ x 1.0″)	10.0

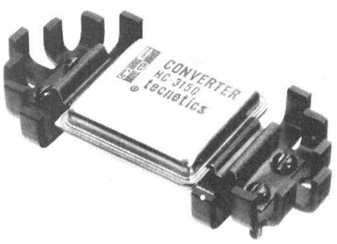
Note: DC0510 retainer is required and must be ordered separately. See page 5-18 for ordering information and dimensional drawing.

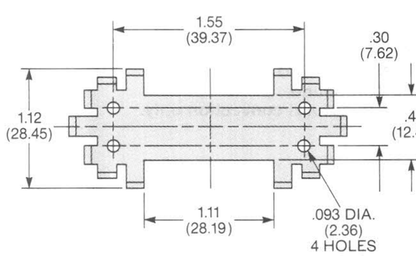
Heat dissipators for dual DIP packages

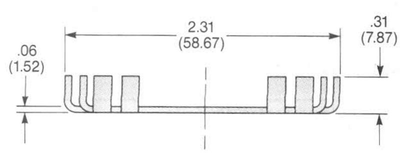
- Specially designed for use with dual in-line packages with lead spacing of .600″.
- The two dissipators — LBOC and HPI — will accommodate a typical package measuring .940″ x 1.05″ x .300″ high and has a flange height of .150″.
- Hole patterns for other devices with different lengths and widths can be provided upon request.
- Clamp material: beryllium copper.

LBOC2-72 Series

(Retainer required. See note.)

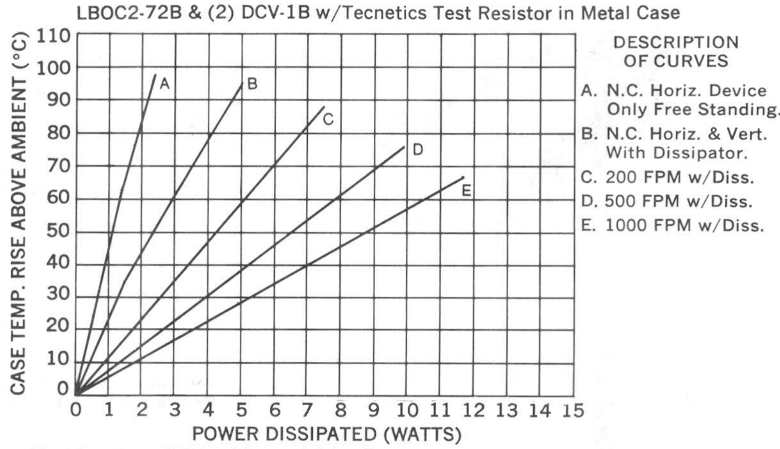






Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

LBOC2-72B & (2) DCV-1B w/Tecnetics Test Resistor in Metal Case



- Test Conducted Using Thermal Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 0.6 °C/watt for Insulube® part in natural convection only.

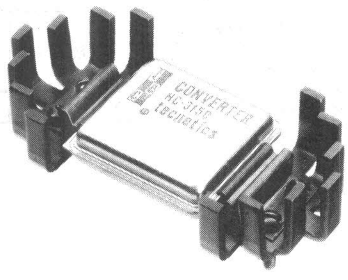
Ordering Information

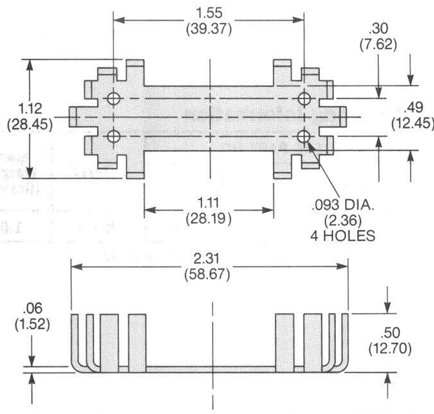
IERC PART NO.				Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LBOC2-72U	LBOC2-72CB	LBOC2-72B	LBOC2-72	Metal case microcircuit (.600″ lead spacing)	5.4

Note: Two DCV-1 retainers are required and must be ordered separately. See page 5-18 for ordering information and dimensional drawings.

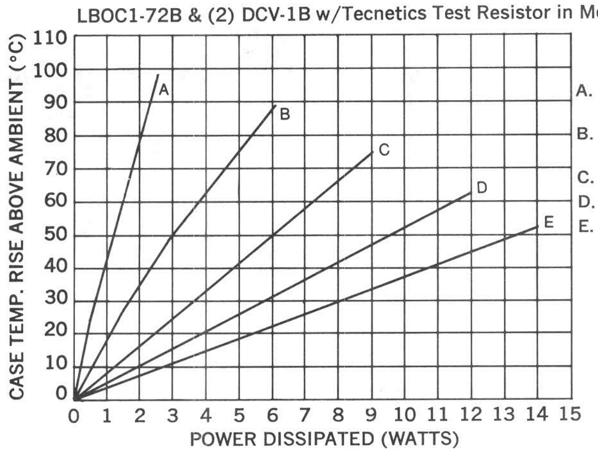
LBOC1-72 Series

(Retainer required.
See note.)





Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.



- Test Conducted Using Thermal Joint Compound.
- Derate 0.8 °C/watt for unplated part in natural convection only.
- Derate 0.6 °C/watt for Insulube® part in natural convection only.

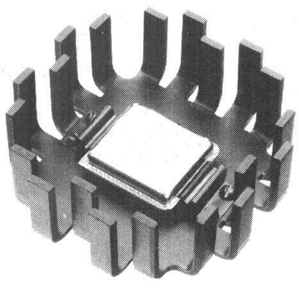
Ordering Information

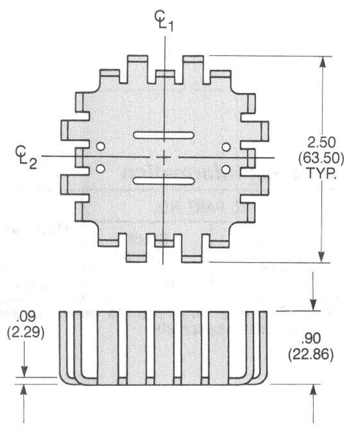
	IERC PART NO.			Semiconductor Accommodated	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®		
LBOC1-72U	LBOC1-72CB	LBOC1-72B	LBOC1-72	Metal case micro-circuit (.600″ lead spacing)	7.4

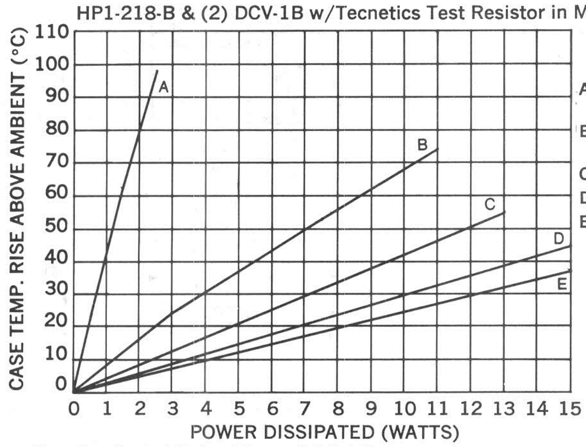
Note: Two DCV-1 retainers are required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawings.

HP1-218 Series

(Retainer required.
See note.)







- Test Conducted Using Thermal Joint Compound.
- Derate 1.0 °C/watt for unplated part in natural convection only.
- Derate 0.6 °C/watt for Insulube® part in natural convection only.

	IERC PART NO.			Semiconductor Accommodated	Hole patt. ref. no. (see pg. 5-19)	Max. Weight (Grams)
Unplated	Comm'l. Black Anodize	Mil. Black Anodize	Insulube 448®			
HP1-218-U	HP1-218-CB	HP1-218-B	HP1-218	Metal case microcircuit (.600″ lead spacing)	3	35.0

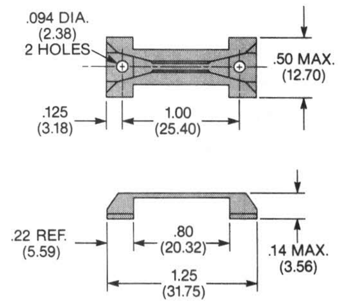
Note: Two DCV-1 retainers are required and must be ordered separately.
See page 5-18 for ordering information and dimensional drawings.

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.

Retainers for DIPs, flatpacks and microcircuits

DC000080-2

Retainer for .300″ DIPs (less than .770″ long). For use with LIC214, UP1, UP2, UP and HP1-348 Series heat dissipators.

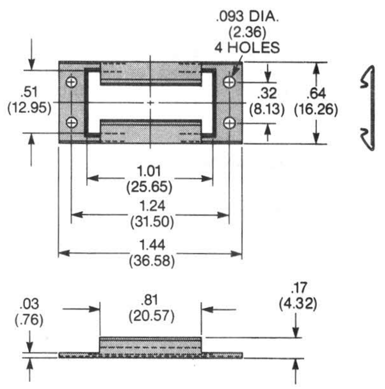


Ordering Information

IERC PART NO.		Material	Max. Weight (Grams)
Unplated	Black Cadmium		
DC000080-2U	DC000080-2B	Be Cu	0.7

DC0510

Retainer for .500″ wide microcircuits. For use with LBOC1-60, LBOC1-61, LBOC2-60, LBOC2-61 Series heat dissipators. Retainer may be used separately.



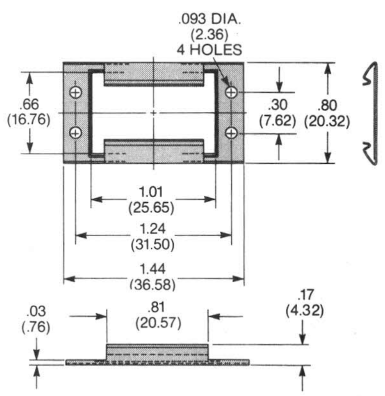
Ordering Information

IERC PART NO.		Material	Max. Weight (Grams)
Unplated	Black Cadmium		
DC0510U	DC0510B	Be Cu	1.0

Note: Retainer may be used separately.

DC065100

Retainer for .650″ wide microcircuits. For use with LBOC1-65 and LBOC2-65 Series heat dissipators. Retainer may be used separately.



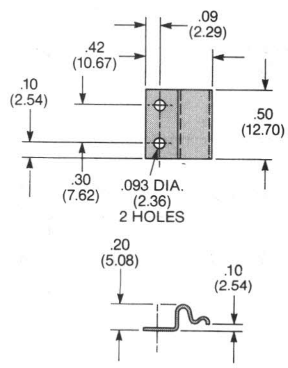
Ordering Information

IERC PART NO.		Material	Max. Weight (Grams)
Unplated	Black Cadmium		
DC065100U	DC065100B	Be Cu	1.1

Note: Retainer may be used separately.

DCV-1

Retainer for metal case microcircuits and .600″ wide Dual DIPs. For use with LBOC1-72, LBOC2-72, and HP1-218 Series heat dissipators. Fits metal cases with flange heights between .100″ and .150″ and .600″ wide DIPs. Two retainers required for each device.



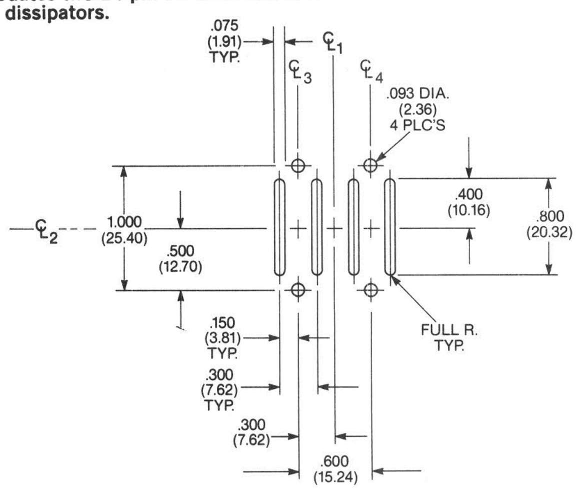
Ordering Information

IERC PART NO.		Material	Max. Weight (Grams)
Unplated	Black Cadmium		
DCV-1U	DCV-1B	Be Cu	0.5

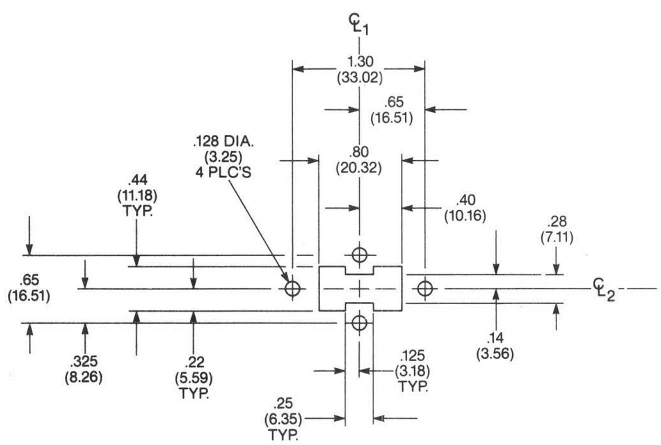
Note: Two retainers required per dissipator; retainers may be used separately.

Hole patterns for DIPs, flatpacks and microcircuits

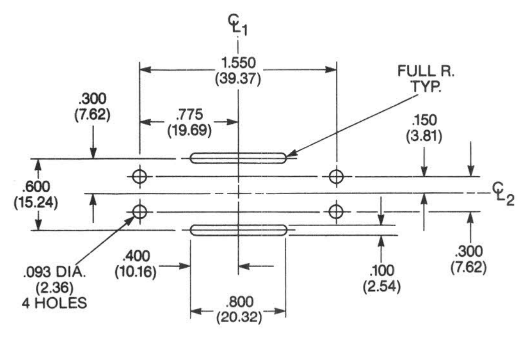
1. Hole pattern no. 348 accommodates two 14-pin DIPs. Available in UP, UP1, UP2 and HP1 series dissipators.



2. Hole pattern no. 414 accommodates one MP324. Available in LA series heat dissipators.



3. Hole pattern no. 218 accommodates one metal case microcircuit. Available in HP1 series heat dissipators.



SECTION 6

EXTRUDED HEAT SINKS, FOR HIGH-POWER SEMICONDUCTORS

SECTION 6

EXTRUDED HEAT SINKS FOR HIGH-POWER SEMICONDUCTORS

Available in all popular configurations, or customized to meet your specific needs

In addition to manufacturing an extensive line of stamped metal heat sinks, IERC also supplies many different *extruded* heat sinks for applications where cost is a factor or extremely high power levels are encountered. Application data on the popular extruded heat sink sizes and configurations, commonly used in thermal packaging, appears in this section.

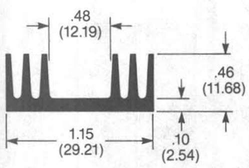
To provide special assistance in meeting your thermal packaging requirements, IERC will:

- Cut to length,
- Drill, punch, tap or notch hole as required,
- Provide finishes to your requirements, and
- Do special machining on any of our configurations to your specifications.

We manufacture and deliver all extrusions to your drawing and/or part number. Our configuration number assists you in your material call-out.

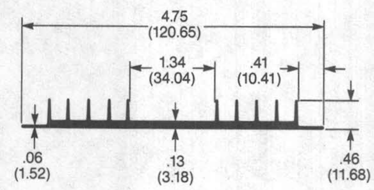
To assist you in selecting the proper extrusion to solve your thermal problems, the following information is provided for each configuration: weight (WT.) in lb./ft., heat-dissipating surface (H.D.S.) area in sq. in./in., and thermal resistance (T.R.) figures for a 3-inch long, black-anodized section. If you do not find the exact configuration you need, contact your local IERC technical sales representative or our factory. Our expert technical staff is ready to assist you with your thermal packaging problem.

We maintain a large inventory of extruded heat sink stock. Our prices are competitive. We welcome the chance to be of service to you.



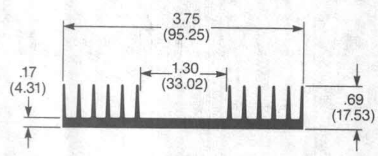
E088

WT. .23 lbs./ft. (.34 kg./m.)
H.D.S. 6.8 sq.in./in. (17.2 sq.cm./cm.)
T.R. 7.4°C/W



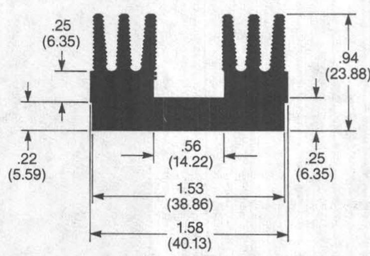
E130

WT. .81 lbs./ft. (1.21 kg./m.)
H.D.S. 16.0 sq. in./in. (40.6 sq. cm./cm.)
T.R. 2.9 °C/W



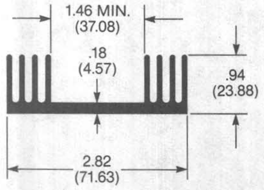
E200

WT. 1.3 lbs./ft. (1.93 kg./m.)
H.D.S. 19.5 sq. in./in. (49.5 sq. cm./cm.)
T.R. 3.0 °C/W



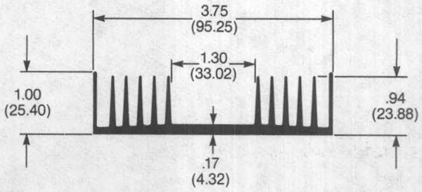
E227

WT. 1.0 lbs./ft. (1.51 kg./m.)
H.D.S. 12.1 sq. in./in. (30.8 sq. cm./cm.)
T.R. 5.0 °C/W



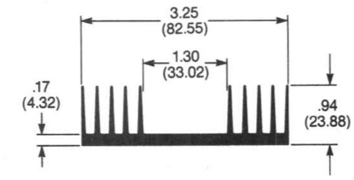
E228

WT. 1.1 lbs./ft. (1.68 kg./m.)
H.D.S. 17.5 sq. in./in. (44.5 sq. cm./cm.)
T.R. 2.7 °C/W



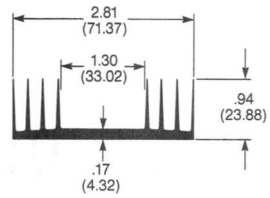
E236

WT. 1.5 lbs./ft. (2.28 kg./m.)
H.D.S. 26.2 sq. in./in. (66.6 sq. cm./cm.)
T.R. 2.0 °C/W



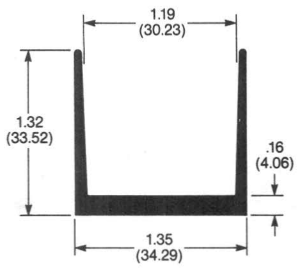
E237

WT.	1.3 lbs./ft. (1.95 kg./m.)
H.D.S.	21.8 sq. in./in. (55.4 sq. cm./cm.)
T.R.	2.3 °C/W



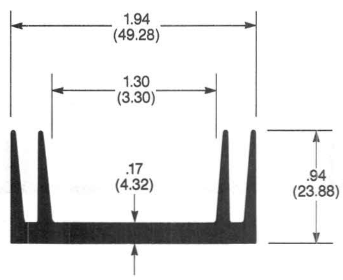
E238

WT.	1.1 lbs./ft. (1.59 kg./m.)
H.D.S.	18.0 sq. in./in. (45.7 sq. cm./cm.)
T.R.	2.7 °C/W



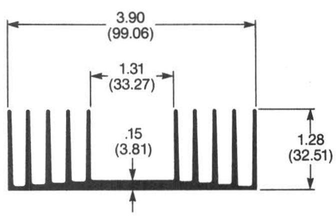
E267

WT.	.45 lbs./ft. (.67 kg./m.)
H.D.S.	7.6 sq. in./in. (19.2 sq. cm./cm.)
T.R.	4.5 °C/W



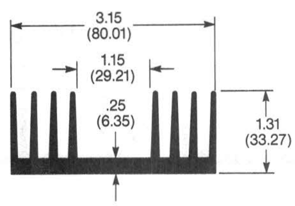
E240

WT.	.66 lbs./ft. (.98 kg./m.)
H.D.S.	10.5 sq. in./in. (26.7 sq. cm./cm.)
T.R.	4.6 °C/W



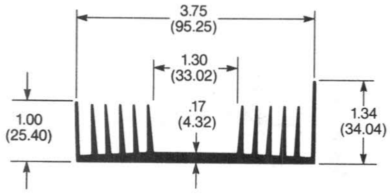
E260

WT.	1.6 lbs./ft. (2.40 kg./m.)
H.D.S.	30.8 sq. in./in. (78.2 sq. cm./cm.)
T.R.	1.8 °C/W



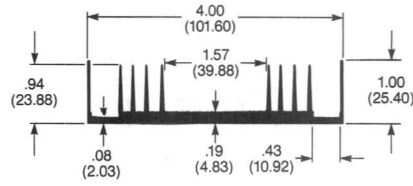
E275

WT.	1.8 lbs./ft. (2.71 kg./m.)
H.D.S.	23.4 sq. in./in. (59.4 sq. cm./cm.)
T.R.	2.6 °C/W



E234

WT.	1.6 lbs./ft. (2.32 kg./m.)
H.D.S.	27.6 sq. in./in. (70.1 sq. cm./cm.)
T.R.	2.1 °C/W

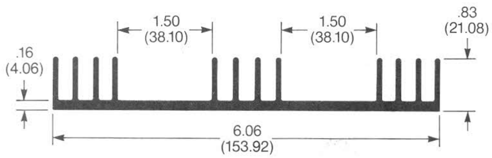


E235

WT.	1.4 lbs./ft. (2.11 kg./m.)
H.D.S.	23.7 sq. in./in. (60.2 sq. cm./cm.)
T.R.	2.2 °C/W

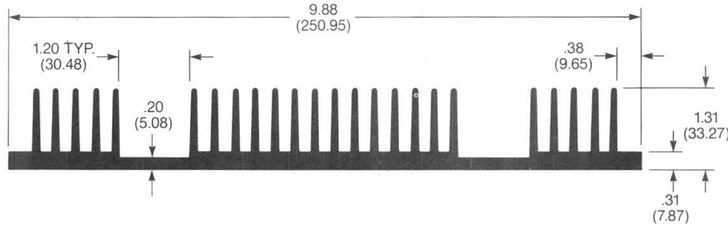
H.D.S.	32.3 sq. in./in. (82.0 sq. cm./cm.)
T.R.	1.8 °C/W

H.D.S.	24.0 sq. in./in. (61.0 sq. cm./cm.)
T.R.	1.8 °C/W



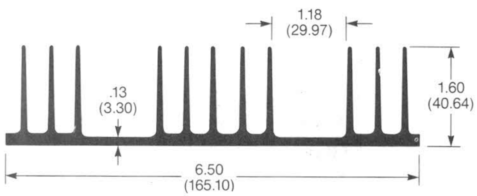
E222

WT.	1.90 lbs./ft. (2.83 kg./m.)
H.D.S.	28.6 sq. in./in. (72.7 sq. cm./cm.)
T.R.	2.1 °C/W



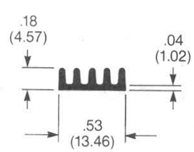
E288

WT.	5.5 lbs./ft. (8.23 kg./m.)
H.D.S.	65.7 sq. in./in. (166.9 sq. cm./cm.)
T.R.	1.0 °C/W



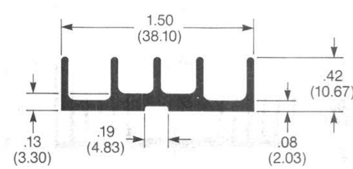
E360

WT.	2.7 lbs./ft. (4.08 kg./m.)
H.D.S.	43.2 sq. in./in. (109.7 sq. cm./cm.)
T.R.	1.4 °C/W



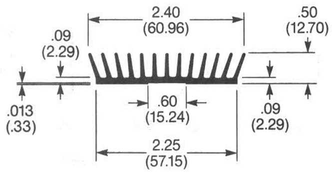
E114

WT.	.07 lbs./ft. (.10 kg./m.)
H.D.S.	2.28 sq. in./in. (5.8 sq. cm./cm.)
T.R.	22.0 °C/W



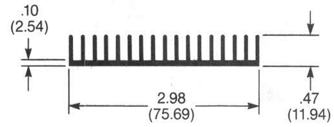
E127

WT.	.31 lbs./ft. (.46 kg./m.)
H.D.S.	5.3 sq. in./in. (13.5 sq. cm./cm.)
T.R.	5.6 °C/W



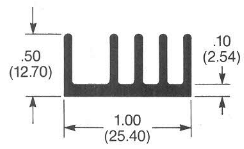
E155

WT. .59 lbs./ft. (.87 kg./m.)
H.D.S. 17.4 sq. in./in. (44.1 sq. cm./cm.)
T.R. 2.4 °C/W



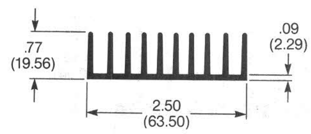
E108

WT. .76 lbs./ft. (1.13 kg./m.)
H.D.S. 18.0 sq. in./in. (45.7 sq. cm./cm.)
T.R. 2.6 °C/W



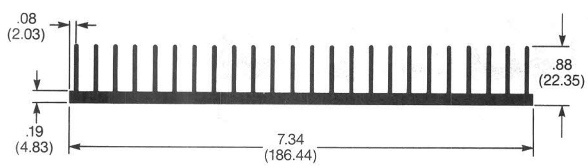
E157

WT. .32 lbs./ft. (.48 kg./m.)
H.D.S. 6.1 sq. in./in. (15.4 sq. cm./cm.)
T.R. 9.1 °C/W



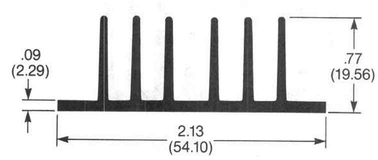
E216

WT. .81 lbs./ft. (1.21 kg./m.)
H.D.S. 18.4 sq. in./in. (46.7 sq. cm./cm.)
T.R. 3.4 °C/W



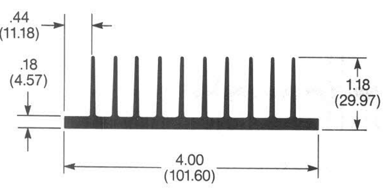
E223

WT. 2.9 lbs./ft. (4.3 kg./m.)
H.D.S. 46.8 sq. in./in. (118.9 sq. cm./cm.)
T.R. 1.3 °C/W



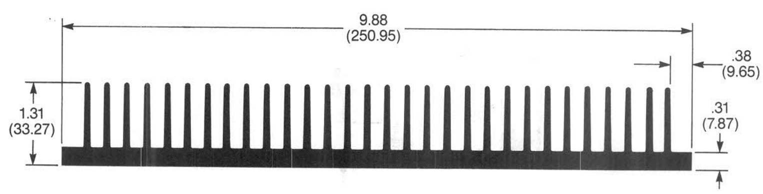
E218

WT. .56 lbs./ft. (.83 kg./m.)
H.D.S. 12.7 sq. in./in. (32.2 sq. cm./cm.)
T.R. 5.4 °C/W



E256

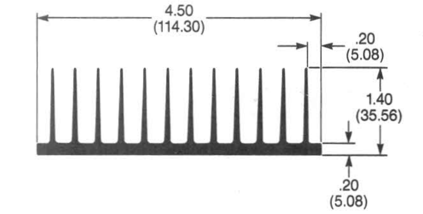
WT. 1.8 lbs./ft. (2.65 kg./m.)
H.D.S. 27.4 sq. in./in. (69.6 sq. cm./cm.)
T.R. 2.3 °C/W



E280

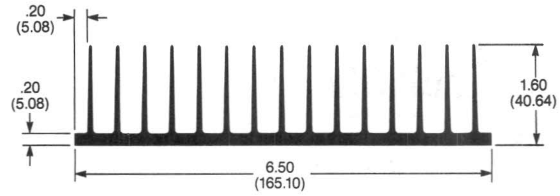
WT. 6.20 lbs./ft. (9.22 kg./m.)
H.D.S. 77.9 sq. in./in. (197.9 sq. cm./cm.)
T.R. .9 °C/W

EXTRUDED HEAT SINKS FOR HIGH-POWER SEMICONDUCTORS



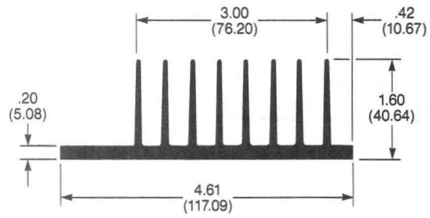
E310

WT. 2.61 lbs./ft. (3.9 kg./m.)
H.D.S. 36.5 sq. in./in. (92.7 sq. cm./cm.)
T.R. 1.6 °C/W



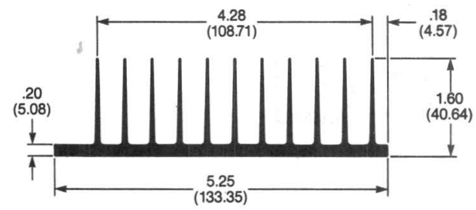
E350

WT. 3.5 lbs./ft. (5.16 kg./m.)
H.D.S. 54.2 sq. in./in. (137.7 sq. cm./cm.)
T.R. 1.2 °C/W



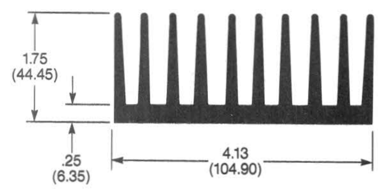
E368

WT. 2.2 lbs./ft. (3.26 kg./m.)
H.D.S. 32.0 sq. in./in. (81.3 sq. cm./cm.)
T.R. 2.7 °C/W



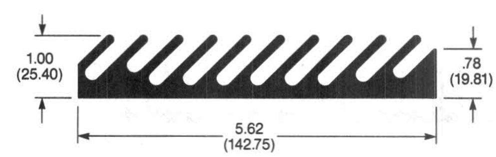
E365

WT. 2.8 lbs./ft. (4.09 kg./m.)
H.D.S. 40.7 sq. in./in. (103.4 sq. cm./cm.)
T.R. 1.5 °C/W



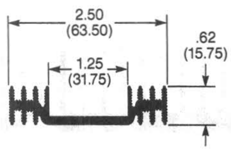
E375

WT. 3.5 lbs./ft. (5.10 kg./m.)
H.D.S. 38.1 sq. in./in. (96.8 sq. cm./cm.)
T.R. 1.5 °C/W



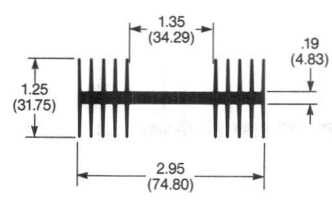
E918

WT. 3.1 lbs./ft. (4.67 kg./m.)
H.D.S. 29.8 sq. in./in. (75.6 sq. cm./cm.)
T.R. 1.7 °C/W



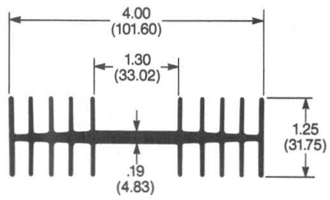
E572

WT. .64 lbs./ft. (.95 kg./m.)
H.D.S. 15.1 sq. in./in. (38.3 sq. cm./cm.)
T.R. 4.3 °C/W

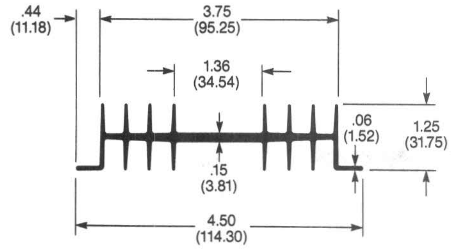


E461

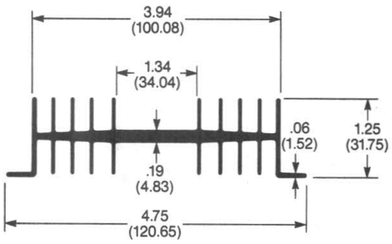
WT. 1.3 lbs./ft. (1.89 kg./m.)
H.D.S. 26.7 sq. in./in. (67.9 sq. cm./cm.)
T.R. 2.4 °C/W



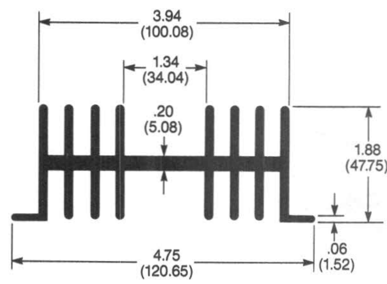
E472
WT. 1.6 lbs./ft. (2.35 kg./m.)
H.D.S. 30.4 sq. in./in. (77.2 sq. cm./cm.)
T.R. 2.1 °C/W



E101
WT. 1.3 lbs./ft. (1.89 kg./m.)
H.D.S. 26.9 sq. in./in. (68.3 sq. cm./cm.)
T.R. 2.0 °C/W

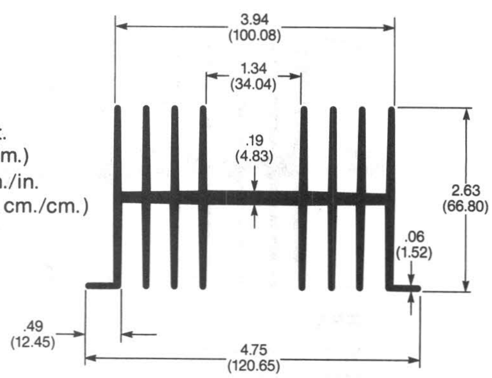


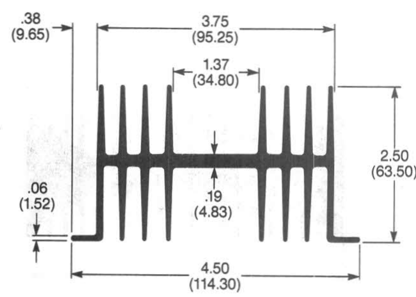
E470
WT. 1.6 lbs./ft. (2.4 kg./m.)
H.D.S. 29.6 sq. in./in. (75.2 sq. cm./cm.)
T.R. 1.8 °C/W



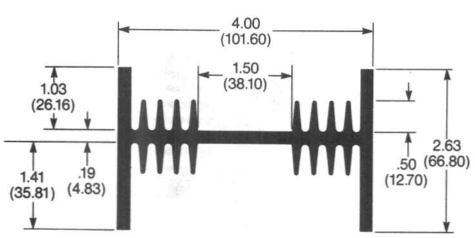
E490
WT. 2.4 lbs./ft. (3.63 kg./m.)
H.D.S. 34.3 sq. in./in. (87.1 sq. cm./cm.)
T.R. 1.6 °C/W

E520
WT. 2.6 lbs./ft. (3.82 kg./m.)
H.D.S. 48.1 sq. in./in. (122.2 sq. cm./cm.)
T.R. 1.3 °C/W





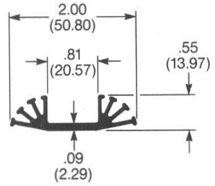
E102
WT. 2.2 lbs./ft. (3.20 kg./m.)
H.D.S. 38.7 sq. in./in. (98.3 sq. cm./cm.)
T.R. 1.5 °C/W



E540
WT. 2.9 lbs./ft. (4.34 kg./m.)
H.D.S. 31.8 sq. in./in. (80.8 sq. cm./cm.)
T.R. 2.0 °C/W

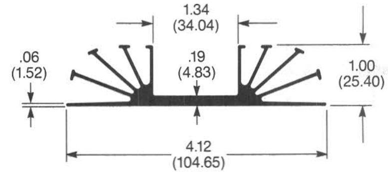
WT. 1.1 lbs./ft. (1.68 kg./m.)
H.D.S. 20.7 sq. in./in. (52.6 sq. cm./cm.)
T.R. 2.9 °C/W

WT. 1.5 lbs./ft. (2.20 kg./m.)
H.D.S. 32.4 sq. in./in. (82.3 sq. cm./cm.)
T.R. 2.3 °C/W



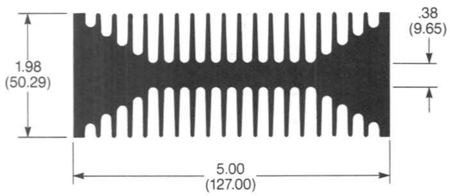
E913

WT. .37 lbs./ft. (.55 kg./m.)
H.D.S. 9.9 sq. in./in. (25.2 sq. cm./cm.)
T.R. 5.0 °C/W



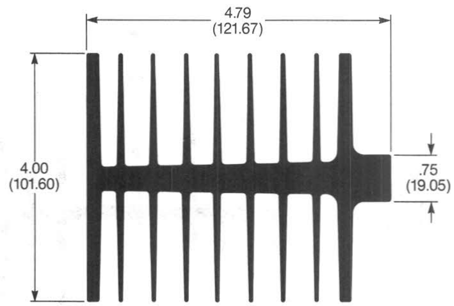
E915

WT. 1.3 lbs./ft. (1.86 kg./m.)
H.D.S. 25.0 sq. in./in. (63.5 sq. cm./cm.)
T.R. 2.1 °C/W



E489

WT. 7.2 lbs./ft. (10.71 kg./m.)
H.D.S. 55.65 sq. in./in. (141.3 sq. cm./cm.)
T.R. 1.2 °C/W

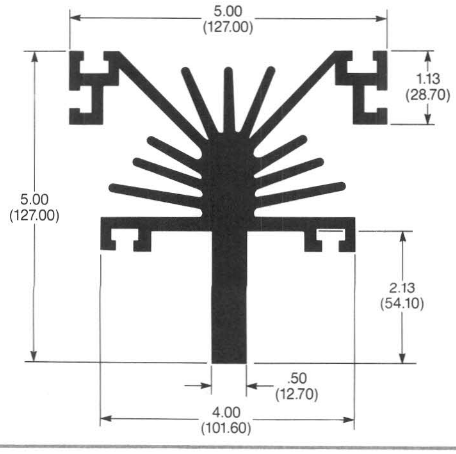


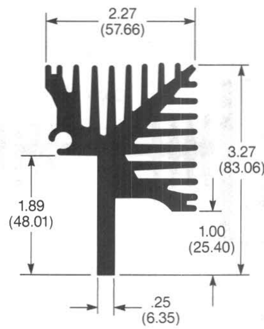
E585

WT. 7.1 lbs./ft. (10.50 kg./m.)
H.D.S. 70.2 sq. in./in. (178.3 sq. cm./cm.)
T.R. .8 °C/W

E587

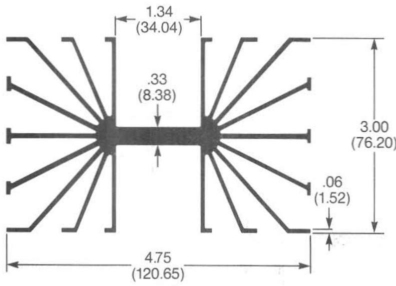
WT. 6.2 lbs./ft. (9.22 kg./m.)
H.D.S. 55.3 sq. in./in. (140.5 sq. cm./cm.)
T.R. 1.1 °C/W





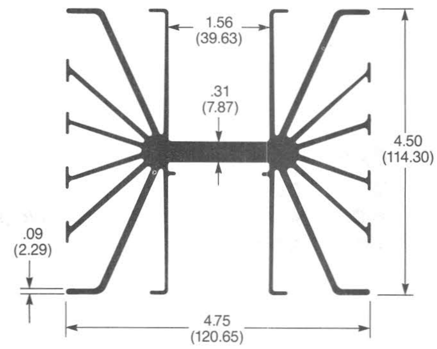
E755

WT. 3.2 lbs./ft. (4.80 kg./m.)
H.D.S. 32.0 sq. in./in. (78.7 sq. cm./cm.)
T.R. 2.0 °C/W

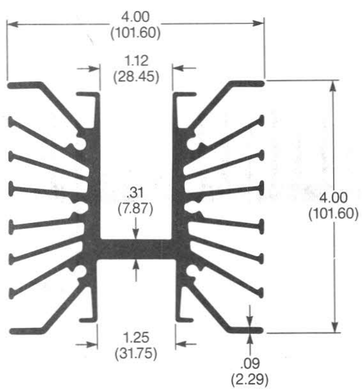


E613
WT. 3.0 lbs./ft. (4.46 kg./m.)
H.D.S. 61.3 sq. in./in. (155.7 sq. cm./cm.)
T.R. 1.1 °C/W

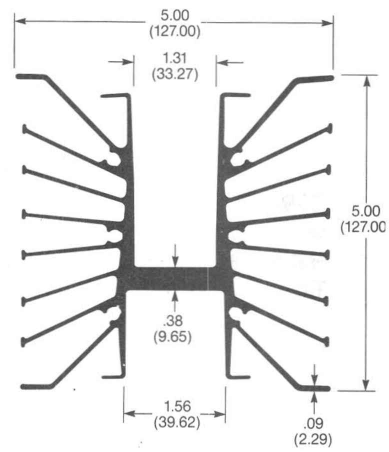
E615
WT. 4.1 lbs./ft.
(6.12 kg./m.)
H.D.S. 71.4 sq. in./in.
(181.4 sq. cm./cm.)
T.R. .81 °C/W



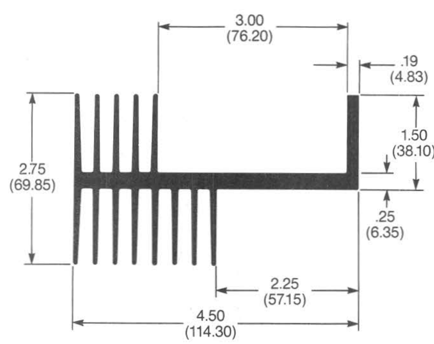
E603
WT. 4.3 lbs./ft.
(6.32 kg./m.)
H.D.S. 64.3 sq. in./in.
(163.3 sq. cm./cm.)
T.R. .9 °C/W

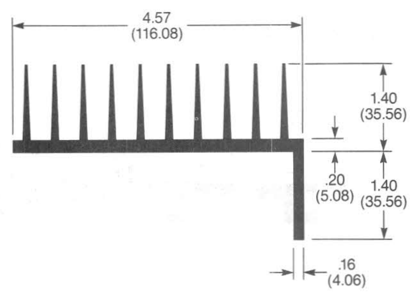


E605
WT. 5.2 lbs./ft.
(7.72 kg./m.)
H.D.S. 81.9 sq. in./in.
(208.2 sq. cm./cm.)
T.R. .72 °C/W

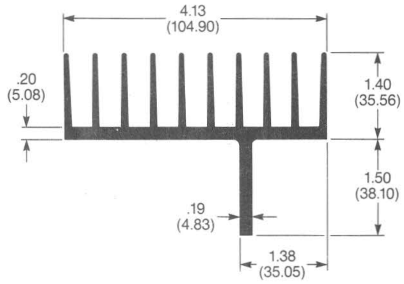


E993
WT. 3.2 lbs./ft.
(3.78 kg./m.)
H.D.S. 41.4 sq. in./in.
(105.1 sq. cm./cm.)
T.R. 1.2 °C/W

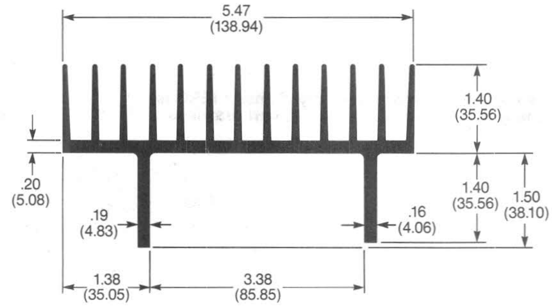




E986
WT. 2.5 lbs./ft. (3.78 kg./m.)
H.D.S. 35.3 sq. in./in. (89.7 sq. cm./cm.)
T.R. 1.6 °C/W

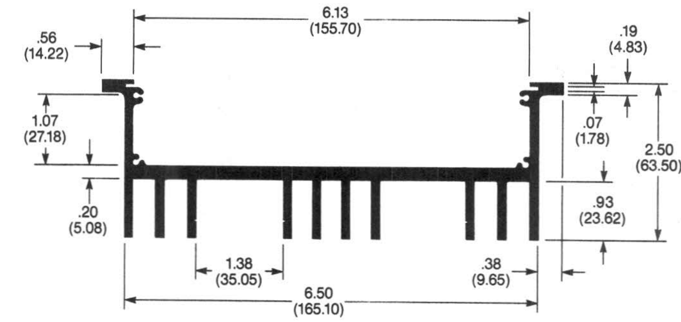


E985
WT. 2.8 lbs./ft. (4.14 kg./m.)
H.D.S. 35.0 sq. in./in. (88.9 sq. cm./cm.)
T.R. 1.6 °C/W



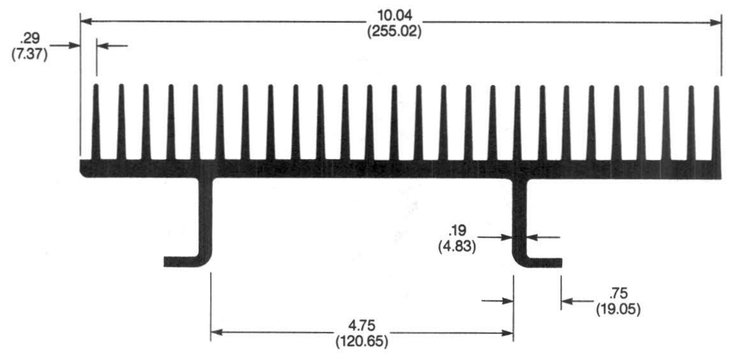
E995
WT. 3.9 lbs./ft. (5.76 kg./m.)
H.D.S. 47.2 sq. in./in. (119.9 sq. cm./cm.)
T.R. 1.3 °C/W

EXTRUDED HEAT SINKS FOR HIGH-POWER SEMICONDUCTORS



E976

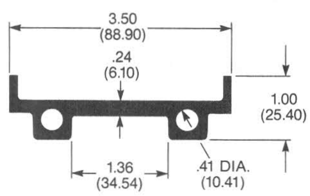
WT. 3.6 lbs./ft. (5.33 kg./m.)
H.D.S. 40.4 sq. in./in. (102.6 sq. cm./cm.)
T.R. 1.8 °C/W



E990

WT. 7.7 lbs./ft. (11.47 kg./m.)
H.D.S. 85.1 sq. in./in. (216.3 sq. cm./cm.)
T.R. .8 °C/W

Liquid Cooled



E104

WT. 1.6 lbs./ft. (2.37 kg./m.)
H.D.S. 12.9 sq. in./in. (32.8 sq. cm./cm.)
T.R. .175 °C/W @ 1 GPM H_2O

Dimensions are for reference use only. Contact IERC for dimensions with tolerances or standard part drawings.